AGRICULTURE IN SACRAMENTO'S NORTH NATOMAS AREA: PRODUCTION, ECONOMIC IMPACTS AND URBAN CONVERSION ISSUES

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Also appreciated are the information and observations provided by many others whose names appear in the List of Persons Contacted at the conclusion of the report.

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PREFACE

THE PURPOSE OF THIS REPORT

Whether or when agricultural lands in the North Natomas area should be made available for urban use is a local question which forms part of a broader national concern. As in Sacramento, urban land uses elsewhere have been expanding onto agricultural land, and California farmland seems particularly susceptible to urbanization. The physical size of the North Natomas area (roughly fifty square miles) distinguishes this situation from the incremental, undramatic pattern of land use transition which has been typical of urbanizing areas in the past, and the attention paid to this question by government agencies and the public has gone well beyond the usual level of interest in a particular potential conversion. The policy issue Sacramento faces is, in part, that of the city's willingness to forego present and potential future benefits of continued agricultural activity in the North Natomas in exchange for the benefits attributed to urban development. The purpose which this report addresses is to ensure that public actions to permit, retard or halt conversion are properly supported by consideration of the facts, to the extent that they are known.

WHY IS AGRICULTURAL LAND RETENTION AN ISSUE?

California cities experienced enormous growth in the twentieth century before an alarm about loss of agricultural land was raised. Concern about conversion is a recent phenomenon, intensified in the 1970s by a number of changes and events in a wide variety of areas.

International Surplus of Foodstuffs Has Declined

Grains in particular have been a surplus commodity through much of the post-war period, but market slack has been taken up by population increases at home and abroad, the opening of new markets for American agriculture and the increasing

diversity of uses for agricultural production. The reduction in the surplus removes a psychological cushion and shifts public attention from the question of how to manage a surplus to the question of whether our productive capability is falling behind our future needs.

Productivity Gains Have Tapered Off

A number of analyses completed in the 1970s have shown that yields on basic commodities such as wheat have not been increasing in recent years at the rate they increased earlier in the century. Among the explanations for a decline in the rate of productivity growth are rising input costs, lack of reserve water supplies, loss of soil fertility, and shift of agricultural operations from more fertile to less fertile soils. Some commentators believe that genetic engineering will compensate for some or all of these changes, and that productivity will make quantum leaps in the coming decades, but this view is by no means unanimous, and the climate of confidence about agricultural productivity which prevailed earlier in the century has changed to one of uncertainty.

Agricultural Land as an Energy Resource

The energy crisis has drawn attention to variety of home-grown tactics for limiting dependence on foreign energy supplies. Energy from biomass is one of these. To the extent one believes in the likelihood of our having someday to do without foreign energy resources, use of farmland for energy production may seem an important option to maintain.

Demographic Changes Are Pressuring Rural, as Well as Urban, Lands

The single most important change noted by analysts of the 1980 Census is the growth of nonmetropolitan counties: for the first time since the federal government began counting Americans, rural areas grew faster than urban areas in the past decade. That means that farmland may be facing a two-pronged attack: from urban expansion at the edges of metropolitan areas (which has been well documented for many decades) and from an ex-urban population moving out into rural areas - what has been called nonmunicipal urbanization.

The foregoing are some of the changes in the 1970s which have drawn wide attention to the question of whether more consistent and more effective measures to maintain the productive capacity of the nation's agricultural industry are needed.

This report provides an opportunity to focus both national and local perceptions of agricultural land planning issues on a specific area: Sacramento's North Natomas area.

AGRICULTURE IN THE NORTH NATOMAS AND THE REGION: IMPACTS AND ISSUES

I. THE SETTING

THE HISTORICAL CONTEXT

Sacramento County has long been an important agricultural area and its agricultural importance has increased in the postwar period. The value of the county's agricultural product doubled, in constant dollars, between 1945 and 1974. In 1969, Sacramento County was ranked 87th among the nation's top agricultural counties and 21st among California's. By 1974, it had risen to 59th place in the nation and 18th in the state. While the value of the county's agricultural product dropped in the mid-1970s, it has recently risen again. Table 1 presents data on the gross value of agricultural commodities produced in the county translated into dollars of constant value.

Table 1

Value of Agricultural Production in Sacramento County in Selected Years

Value of Total Agricultural Production	Current Dollar Values ($millions)	Constant 1979 Dollar Values ($millions)
1945	32.4	99.8
1962	67.1	165.1
1969	77.3	170.8
1972	92.5	178.5
1974	155.4	200.5
1975	133.1	171.7
1976	131.6	165.8
1977	128.1	160.1
1978	141.4	159.8
1979	182.8	182.8

Source: Sacramento County Agricultural Commissioner. *Annual Reports*. Translation to constant dollars based on producer price index for farm products.

Since the 1940s, agricultural production patterns in Sacramento County have remained fairly stable. Seven commodities have generally accounted for two-thirds or more of total agricultural production. Table 2 (p. 3) shows that these top seven crops have maintained steady shares of total agricultural production value since 1947. Tomatoes were the early front runner, declining over the years, while milk has emerged as the leading commodity. Formerly important commodities whose current production is minor are hops and eggs, while both corn and rice have become far more important in recent years than they were in the 1940s.

The northwest portion of Sacramento County receives particular attention in this report. This area, referred to as the North Natomas, is bounded on the west by the Sacramento River (with Yolo County beyond), on the north by the Sutter County line, on the east by Levee Road East and on the south by Interstate 880. The area was submerged until the second decade of the century, when levees were completed on the Sacramento River to the west, at the confluence of the Sacramento and the American Rivers and at the location of what is presently called the East Levee. By 1916 all of this area had been drained and cultivation began, with corn and alfalfa as the first cultivated crops. Irrigated agriculture, with water supplied by a succession of water companies, has continued down to the present, with rice emerging as the most important crop in the last two decades.

Recent notable land use changes in the North Natomas have included Metropolitan Airport (opened October 1967), Interstate 5 (opened July 1969) and Interstate 880 (opened October 1971).

THE SOIL

Of the various systems in general use for classifying soils (see descriptions in Appendix A), the approach selected for use in this study is the one developed by the Soil Conservation Service of U. S. Department of Agriculture: the soils capability classification system. A soil survey using this system is currently under way in Sacramento County, and the preliminary results of that SCS soil survey provide the most up-to-date information available on North Natomas soils.

Table 2

Agricultural Production
in Sacramento County
in Selected Years

Commodities Consistently in the Top Ten	Commodities' Percentages of Total Value of Agricultural Production in: 1980	1971	1958	1947
milk	18.9	11.3	11.7	9.5
corn	17.8	10.4	13.5	[0.3]
cattle & calves	12.6	20.2	15.9	7.2
pears	10.5	8.9	5.1	8.9
tomatoes	6.5	9.6	9.0	11.1
sugar beets	2.5	3.0	4.9	4.0
alfalfa hay	2.5	2.8	5.8	7.1
Subtotal	*71.3*	*66.2*	*65.9*	*48.1*
Other Major Commodities				
wheat	12.4	NT	[1.2]	[2.7]
rice	6.9	3.0	[2.0]	[2.0]
wine grapes	3.1	[0.1]	[0.2]	3.6
hops	[0.7]	[1.5]	5.7	8.4
milo	NT	[2.4]	2.4	[1.3]
eggs	[0.7]	[2.6]	9.0	9.0
dry beans	NT	[<.1]	[0.6]	4.7
safflower	[0.2]	2.9	[0.7]	NT
irrigated pasture	[2.0]	3.1	NT	NT
Top Ten Commodities' Share of Total Production	93.7%	76.0%	83.0%	73.3%

NT = not tabulated
[] = not in top ten that year

Source: Sacramento County Agricultural Commission. *Annual Reports.*

Soils Classification

There are several soils classification systems in common use (Appendix A provides descriptions). The system most frequently used is the land capability classification system developed by SCS. Under this system, all soils are divided into eight classes. Soils falling in the first four classes (I through IV) are suited to cultivation and other uses whereas lands in

last four classes (V through VIII) are limited in use and not generally suited to cultivation. A common definition of "prime" farmland is all soil in SCS classes I and II.

North Natomas Soils and Crop Suitability

A map showing the areal distribution of various soil types in the incorporated portions of the North Natomas area is presented as Figure 1. Information on soil soil mapping unit name, land capability classes and the acreage of each mapping unit in the study area is presented in Table 3 (p. 6). Various limitations are attached to each of the major classes of soils. These constraints are identified by letter and subscripts following the Roman numeral class designations shown in Table 3, and the character of each kind of limitation is described in Table 4 (p. 7).

Preliminary data provided by the current SCS soil survey show that the incorporated North Natomas consists of about 80 percent Class II soils (5,525 acres) and about 17 percent Class III soils (1,200 acres) with the balance Class IV or variable (225 acres).

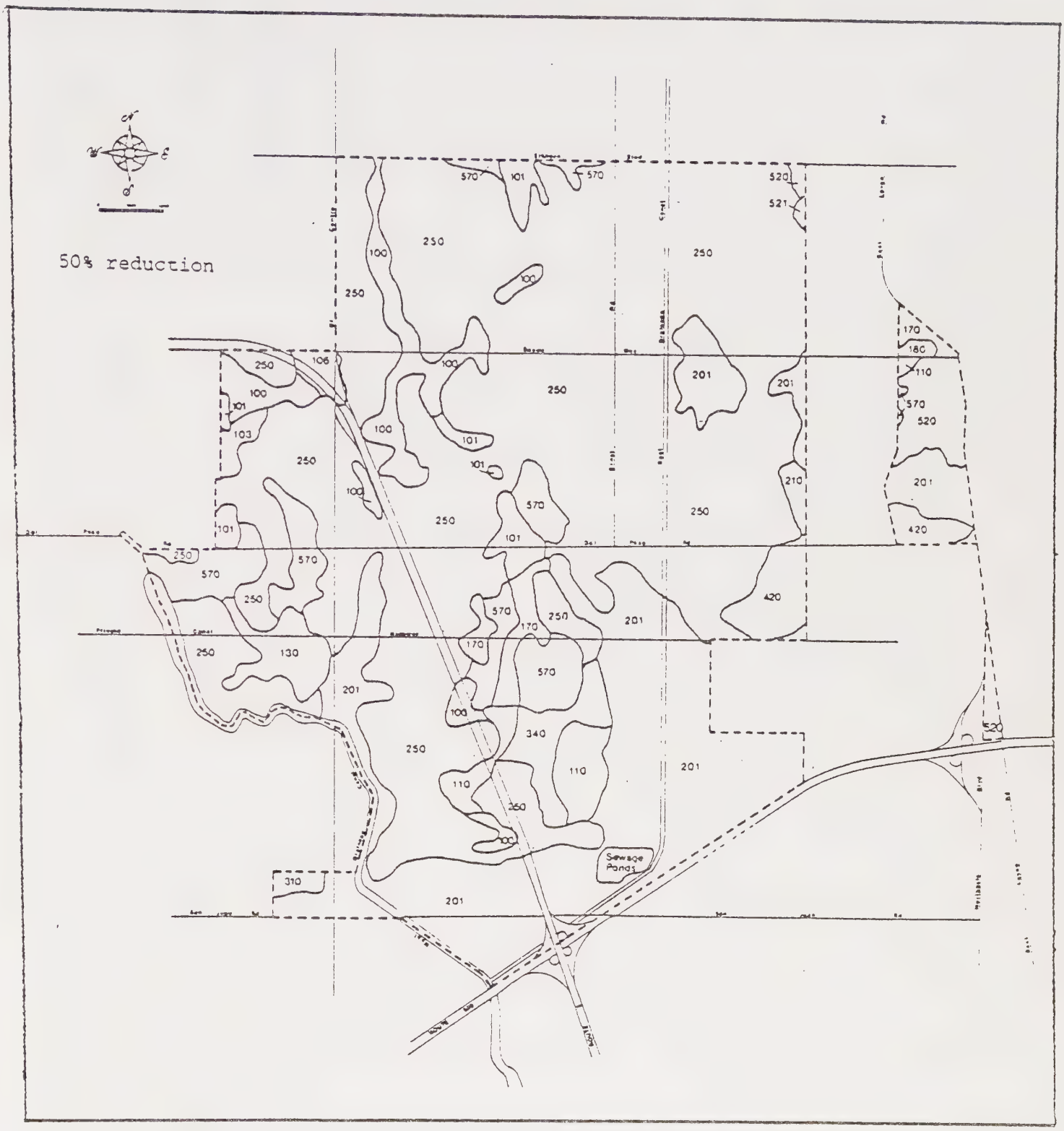
The two predominant soils types are Cosumnes silt loam (Class II w-3; 1,400 acres) and Stockton clay (Class II w-6; 3,900 acres). Together, these types represent about three-fourths of the land in the incorporated portion of the North Natomas. Both of these soils are characterized by poor drainage conditions. Cosumnes silt loam has a slowly permeable substrata, a condition which can easily be compensated for through the use of tile or open ditch drains. Stockton clay has a high clay content throughout the soil profile which both impedes drainage and makes cultivation practices like plowing and disking more difficult.

The drainage characteristics of these two soils types make them well suited to rice cultivation, because rice is a crop which thrives under such conditions. However, the cultivation potential of these soils is by no means limited to rice. Cosumnes silt loam is suitable for the production of all crops normally grown in the Natomas area, while, with proper management, Stockton clay can be put to productive use even for crops requiring extensive tilling operations.

(Text continues p. 8.)

Figure 1

Preliminary Soil Map,
Incorporated Portion of the North Natomas



Note: Numerical designations refer to list of field mapping units presented in Table 3 (p. 6).

Source: H. Esmaili & Associates, based on SCS, 1981 (preliminary, subject to revision).

Table 3

Acreage of Various Soil Types within
the Incorporated Portion of the North Natomas

Field Mapping Unit no.	Mapping Unit Name	Irrigated Capability Class	Acreage
100	San Joaquin Loam, leveled, 0-1 percent slopes	III s-3	86.6
101	San Joaquin loam, 0 to 3 percent slopes	III s-3	270.7
103	San Joaquin - Galt Complex, leveled, 0 to 1 percent slopes	III s-3	49.8
106	San Joaquin - Arents Complex, leveled, 0 to 1 percent slopes	III s-3	35.5
110	Galt Clay, 0 to 2 percent slopes	III s-5	140.2
130	Madera loam, 0 to 2 percent slopes	IV s-3	99.5
170	Durixeralfs, leveled, 0 to 1 percent slopes	IV s-5	92.4
180	Arents, leveled, 0 to 1 percent slopes	Variable	35.5
201	Cosumnes Silt loam, protected	II w-3	1,392.4
210	Sailboat Silt loam, drained	II w-3	18.7
250	Stockton Clay, 0 to 1 percent slopes	II w-5	3,905.2
310	Egbert Clay, Over Wash	II w-2	20.0
340	Capay clay loam	II s-5	95.6
420	Pacheco loam, drained	II w-2	94.3
520	Rida Sandy loam, 0 to 3 percent slopes	III s-8	252.0
521	Rida Sandy loam, 3 to 9 percent slopes	III e-8	9.0
570	Subaco clay (taxadjunct) leveled, 0 to 1 percent slopes	III w-5	352.1
	Total		6,949.5

Source: H. Esmaili & Associates, based on SCS, 1981.

Table 4

Constraint Designations Applicable to
the Incorporated Portion of the North Natomas

Capability Class	Definition	Constraint Designations applicable to North Natomas Area*	
		Subclass	Capability unit
II	Soils which have some limitations that reduce the choice of plants or require moderate conservation practices.	(e) erosion is made up of soils where the susceptibility to erosion is the dominant problem or hazard in their use. Erosion susceptibility and past erosion damage are the major soil factors for placing soils in this subclass.	2 Drainage or overflow hazard. 3 Slowly or very slowly permeable subsoils or substrata. 5 Fine or very fine textures. 8 Hardpan or hard, unweathered bedrock within the root zone.
III	Soils which have severe limitations that reduce the choice of plants or require special conservation practices, or both.	(w) excess water is made up of soils where excess water is the dominant hazard or limitation in their use. Poor soil drainage, wetness, high water table, and overflow are the criteria for determining which soils belong in this subclass.	
IV	Soils whihc have very severe limitations that restrict the choice of plants, require very careful management, or both.	(s) soil limitations within the rooting zone includes, as the name implies, soils that have such limitations as shallowness of rooting zones, stones, low moisture-holding capacity, low fertility difficult to correct, and salinity or sodium.	

* Data are presented only for capability classes designated by SCS for North Natomas soils.

Source: SCS, Agricultural Handbook No. 210, 1973.

The basic soil quality of the North Natomas is such that the area enjoys higher yields and lower production costs per unit of output than other farmland in Sacramento County brought into production more recently (see Table 24, p. 46).

The current SCS soil survey revises and updates the survey conducted in the early 1950s (USDA, 1954). The earlier soil maps designate most of the soils in the eastern part of the incorporated North Natomas as Columbia silty clay (over Sacramento silty clay). This soil was designated as class 2 in a six-class soil classification system. The next major soil was called Alamo clay (adobe) and was designated as class 4. The preliminary results of the more recent soil survey depart from the earlier soil survey by classifying most of the Alamo clay soils as Stockton clay with a capability class of II w-5. Portions of the soils previously designated as Sacramento silty clay loam are also renamed as Stockton clay without a significant change in capability class designation.

In summary, it appears that the more recent soil survey of the Sacramento area, while recognizing the limitations imposed by shallow root zones and poor drainage, upgrades the capability class designation for a major portion of the soils in the incorporated North Natomas.

LAND OWNERSHIP AND FARM OPERATION CHARACTERISTICS

Organization Characteristics of Local Farms

Sacramento County has approximately 1,200 farms of which about 1,000 have annual farm products sales in excess of $2,500 (the 1978 average farm products sales for these farms was $137,000). Looking just at the latter group, the majority were in family or individual ownership in 1978; if we include in that group ownership by family-held corporations, over 80 percent were in family or individual ownership. Table 5 (p. 9) summarizes ownership data drawn from the past three Censuses of Agriculture.

Table 5

Sacramento County Farms
by Type of Organization

	1978	1974	1969
Total Farms with Sales > $2,500	978	911	976
Average No. of Acres	*424*	*476*	*507*
Individual or Family Owned	743	741	795
Average No. of Acres	*NT*	*411*	*477*
Partnership Owned	154	119	138
Average No. of Acres	*NT*	*679*	*637*
Corporation Owned	80*	49	35
Average No. of Acres	*NT*	*NT*	*758*
Owned by Other Types of Entities	1	2	8

* Of these, 72 were held by families.
NT = not tabulated. Data from the 1978 Census of Agriculture are still incomplete.

Source: U. S. Census of Agriculture, 1978: *Preliminary Report*, and U. S. Census of Agriculture, 1974: *Final Report*. Both on Sacramento County.

The proportion of farms in family ownership has remained stable at about 80 percent over the nine-year period covered by Census of Agriculture data.

However, other factors influence a determination of the extent to which agriculture in the county and specifically in the North Natomas area continues to be controlled by individual and family interests, as has been its historic pattern. That is because a "farm" as defined by the Bureau of the Census is an operating unit; the individual owning the farm may own all the land, some of it or none of it. Data from the Censuses of Agriculture in 1969, 1974 and (preliminary) 1978 show an increase in ownership (fewer part owners and fewer tenant farmers), but this reduction in farm tenancy does not necessarily mean that farm operators are more likely to own their own land than in earlier years.

Furthermore, much agricultural property has changed hands in Sacramento County since the 1978 Census of Agriculture. Sales patterns in the North Natomas, in particular, seem to reflect a pattern of sale by agricultural operators to individuals and corporations whose primary fields of activity are non-agricultural. Recent transaction data are presented elsewhere in this report (p. 62), and a display map provided to the Planning Department in connection with this report shows land ownership patterns in the incorporated portion of the North Natomas in 1980.

PRESENT PRODUCTION PATTERNS AND VALUES

Agriculture in the North Natomas is of two major types: rice cultivation, based on the abundant and reliable supply of water to the area, and row and field crops grown in a rotational pattern.

The rotational pattern is needed to maintain the soil, which would be depleted by successive plantings of certain crops. Rotational patterns may be two years (for example, alternating tomatoes and corn) or three years (for example, successive planting of tomatoes, wheat and corn). Tomatoes and sugar beets are considered high value crops, meaning that gross revenues per acre (a function of tons per acre and price per ton) are higher than for other local crops. But because these crops are rotated, their high gross revenues are realized only in alternate years (or even every three years), with the same land producing much lower revenues in other years. Rice, in contrast, need not be rotated, so that land planted to rice has a gross revenue per acre which is less variable than the gross revenue per acre of land cultivated for rotational crops.

Tables 6 and 7 (p. 12) show respectively the acreage distribution and the values of North Natomas crops in 1979, the most recent year for which mapped data are available. Rice accounted for about 47 percent of North Natomas crop acres in 1979; all rotational crops together accounted for another 47 percent. The remaining six percent was accounted for by dry pasture and a variety of other crops, including beans, onions, irrigated pasture, barley, pears, asparagus and sunflowers.

The gross revenue from agricultural production in any given year depends upon: (1) the distribution of acreage among the various crops, (2) the yields (production per acre, usually measured by weight) and (3) the price paid to growers for their crops. Of these three elements, the first is the decision of the farm operator, whose choice reflects the capabilities of the soils at his disposal and his judgment about management, risk and future commodity prices. The second element, yield, is influenced both by the basic soil

Table 6

Acreage Distribution and Yields of
North Natomas Crops, 1979

	Acreage			Yield	Tonnage
	Inside City	Outside City	Total	(Tons per Acre)	(1,000)
Rice	2,950	10,180	13,130	3.25	42.7
Wheat	1,260	3,420	4,680	2.75	12.9
Field Corn	960	2,350	3,310	4.50	14.9
Safflower	70	1,790	1,860	0.90	1.7
Tomatoes	230	850	1,080	25.00	27.0
Sugar Beets	0	390	390	25.00	9.7
Oat (hay)	30	680	710	2.00	1.4
Pasture	140	460	600	-	-
Other	50	1,190	1,240	-	-
Total	5,690	21,310	27,000	-	-

Source: Acreage: See notes to Table 9,p. 15; yields shown are county averages for 1979 as reported in *Crop Report, 1980* except that yields for rice, wheat and corn exceed the county average, based on discussions between M. Esmaili & Associates and the County Director, Cooperative Extension.

Table 7

Value of North Natomas
Crops, 1979

		Tonnage (1,000)			Value ($1,000,000)		
	Unit Value	Inside City	Outside City	Total	Inside City	Outside City	Total
Rice	$180	9.6	33.1	42.7	1.7	6.0	7.7
Wheat	$120	3.5	9.4	12.9	0.4	1.1	1.5
Field Corn	$110	4.3	10.6	14.9	0.5	1.2	1.7
Safflower	$260	<0.1	1.6	1.7	<0.1	0.4	0.4
Tomatoes	$ 57	5.8	21.2	27.0	0.3	1.2	1.5
Sugar Beets	$ 26	0.0	9.7	9.7	0.0	0.3	0.3
Oat (hay)	$ 50	<0.1	1.4	1.4	0.0	0.0	0.0
Dry Pasture	$ 7	-	-	-	0.0	0.0	0.0
Other*	-	-	-	-	<0.1	0.4	0.4
Totals	-	-	-	-	2.9	10.6	13.5

*Estimated to have an aggregate yield of 3.4 tons per acre and an aggregate value of $67 per ton.

Source: Values from Sacramento County Agricultural Commission, Annual Crop and Livestock Report, 1979; tonnage from Table 6.

and by the operator's management practices. (It has been observed that yields tend to drop in advance of urbanization.) Finally, the third element, the price the grower receives for the crop, is outside his control.

Commodity prices change from year to year reflecting overall conditions in a market which can be worldwide in scope. A good example is provided by the prices paid for the 1980 rice crop: the state's two main grower cooperatives, Rice Growers Association of California and Farmer's Rice Cooperative, paid 55 percent and 41 percent more for rice in 1980 than in 1979 (*Sacramento Union*, November 17, 1981). Large purchases by South Korea were cited as one reason for the increase, and 1981 prices are expected to be below 1980 levels.

The grower who plants his land to row crops (say tomatoes) in rotation with grains (say wheat) faces more uncertainty than the grower who plants only rice. The grower of rotational crops sees annual changes in yields and prices in all the crops he currently has in production, while the rice grower's uncertainties are limited to rice. Furthermore, the grower of rotational crops has a bigger management problem, as row crops require more attention throughout the growing season, while the rice grower's effort is more concentrated at planting and harvest times. For these reasons, rice might be a particular grower's preferred crop, but revenues generated by various crops must also be taken into account.

Table 8 provides an example of how rice and rotational crops in the North Natomas compare in terms of gross revenues per acre. Figures in the last two columns reflect the acreage distribution shown in the first column (the 1979 pattern). In the second column are presented gross revenues to North Natomas growers in 1979 assuming average Sacramento County prices in that year. The final column shows what 1979 gross revenues per acre would have been if growers had been paid the prices which they obtained in 1976, when rice prices were somewhat lower relative to prices paid for rotational crops. In 1979 gross revenues per acre for rice were 25 percent higher than gross revenues per acre for rotational crops. However, had commodity prices been the same in 1979 as they were in 1976, gross revenues per acre for rice would have exceeded gross revenues per acre for rotational crops by only four percent: nearly a standoff.

Table 8

Value per Acre of
North Natomas Crops

Crops	1979 Acreage	Gross Revenues per Acre: Based on 1979 Sacramento County Average Prices	Gross Revenues per Acre: Based on 1976 Sacramento County Average Prices
rice	13,130	$586.44	$456.97
rotational crops	10,930	466.61	439.16

Source: Mundie & Associates

The data presented in Table 8 reflect gross revenue, not net revenue or profitability. Crops with higher gross revenues may not be the most profitable crops. A variety of cost and risk management considerations play a part in individual growers' crop mix and management decisions. When market conditions are strong, all crops may be profitable; when market conditions are weak, some crops may not turn a profit. At the present, growers in the North Natomas are probably giving thought to the forecast of a decline in rice prices in the coming years, and may be giving consideration to alternative crops to maintain profitability.

COMPARISONS

The North Natomas Compared with the County of Sacramento

The North Natomas is best known for rice, producing over 80 percent of Sacramento County's rice crop. It also accounts for a significant proportion of Sacramento County acreage planted to other crops, including safflower, processed tomatoes, wheat and sugar beets. Table 9 presents data on North Natomas acreage planted to various crops and shows the percentage of county acreage in each of those crops accounted for by the North Natomas. Altogether, the North Natomas accounts for about eight percent of the county's crop acres and the same proportion of its gross agricultural revenue.

For many crops grown in the North Natomas, yields exceed those obtained elsewhere in the county. Research for this report focused on yields in the incorporated portion of the North Natomas, combining information on local soils types and cropping patterns. Figure 1 (p. 5) shows preliminary results

Table 9

Acreage Distribution of North Natomas Crops
Compared to Sacramento County, 1979

Crops	North Natomas Area			Sacramento County	North Natomas as percent of County
	Inside City	Outside City	Total		
Rice	2,950	10,180	13,130	16,000	.82
Wheat	1,260	3,420	4,680	34,000	.14
Corn	960	2,350	3,310	57,200	.06
Safflower	70	1,790	1,860	11,000	.17
Tomatoes	230	850	1,080	7,223	.15
Sugar Beets	0	390	390	2,800	.14
Oat (hay)	30	680	710	8,700	.08
Pasture	140	460	600	125,000	<.01
Other	50	1,190	1,240	95,041	.01
Total	5,690	21,310	27,000	358,064	.08

Notes: Tabulated data on total North Natomas acreage is based on *Crop Map* (cited below). For crops grown both north and south of Interstate 880, the North Natomas proportion of the total was estimated visually as follows: wheat and corn, 80 percent; safflower, 85 percent; tomatoes, 70 percent; sugar beets, 50 percent; other, 40 percent. Agricultural Commission staff tabulated total crop acres as 30,075; North Natomas crop acreage is roughly 27,000 acres, or about 90 percent of the total. The particular crops tabulated account for about 95 percent of crop acres in the North Natomas. Other crops include beans, onions, barley, pears, asparagus and sunflowers.

Source: Sacramento County Agricultural Commission, *Annual Crop Planning Map for North Natomas,* 1979 (unpublished), and *Sacramento County Crop and Livestock Report, 1979.* Estimate of North Natomas acreage lying within the City of Sacramento by H. Esmaili & Associates.

of the recent soil survey by the Soil Conservation Service for the North Natomas. Based on this survey work, yields for various crops grown in the area have been estimated, and these are compared with county yields for the same crops in Table 10. Yields on rice, corn and sugar beets grown in the incorporated portion of the North Natomas exceed the county averages for those crops. Yields on wheat are about the same as those elsewhere in the county. Yields on processed tomatoes are believed to be lower than the county average, a difference attributable to the local effects of cooler marine winds in the northwestern part of the county.

Table 10

Crop Yields in the Incorporated North Natomas Compared with Sacramento County

Crop	Yields in Tons per Acre In Incorporated North Natomas	In Sacramento County
rice	3.25	3.05
corn	4.50	4.25
wheat	2.75	2.75
tomatoes	25.00	27.00
sugar beets	25.00	23.50

Source: Incorporated North Natomas yields by M. Esmaili & Associates based on discussions with the County Director of the Cooperative Extension and review of SCS soil survey; Sacramento County yields are the average of 1979 and 1980 crop years as reported by the Sacramento County Agricultural Commission.

Superiority of the North Natomas in growing the crops prevalent there is not very surprising, since it would generally be the case that growers would choose to grow those crops most suited to local soils, climate and cultivation conditions.

The North Natomas Compared with the City of Sacramento

In 1976, the City of Sacramento had over 8,000 acres of productive agricultural land. That total includes 5,690 acres in the incorporated portion of the North Natomas and nearly 2,600 acres elsewhere in the city, primarily in the southwest and in the South Natomas. Cropping patterns in the North Natomas are shown in Figure 2; cropping patterns in the city as a whole are shown in Figure 3 (p. 18).

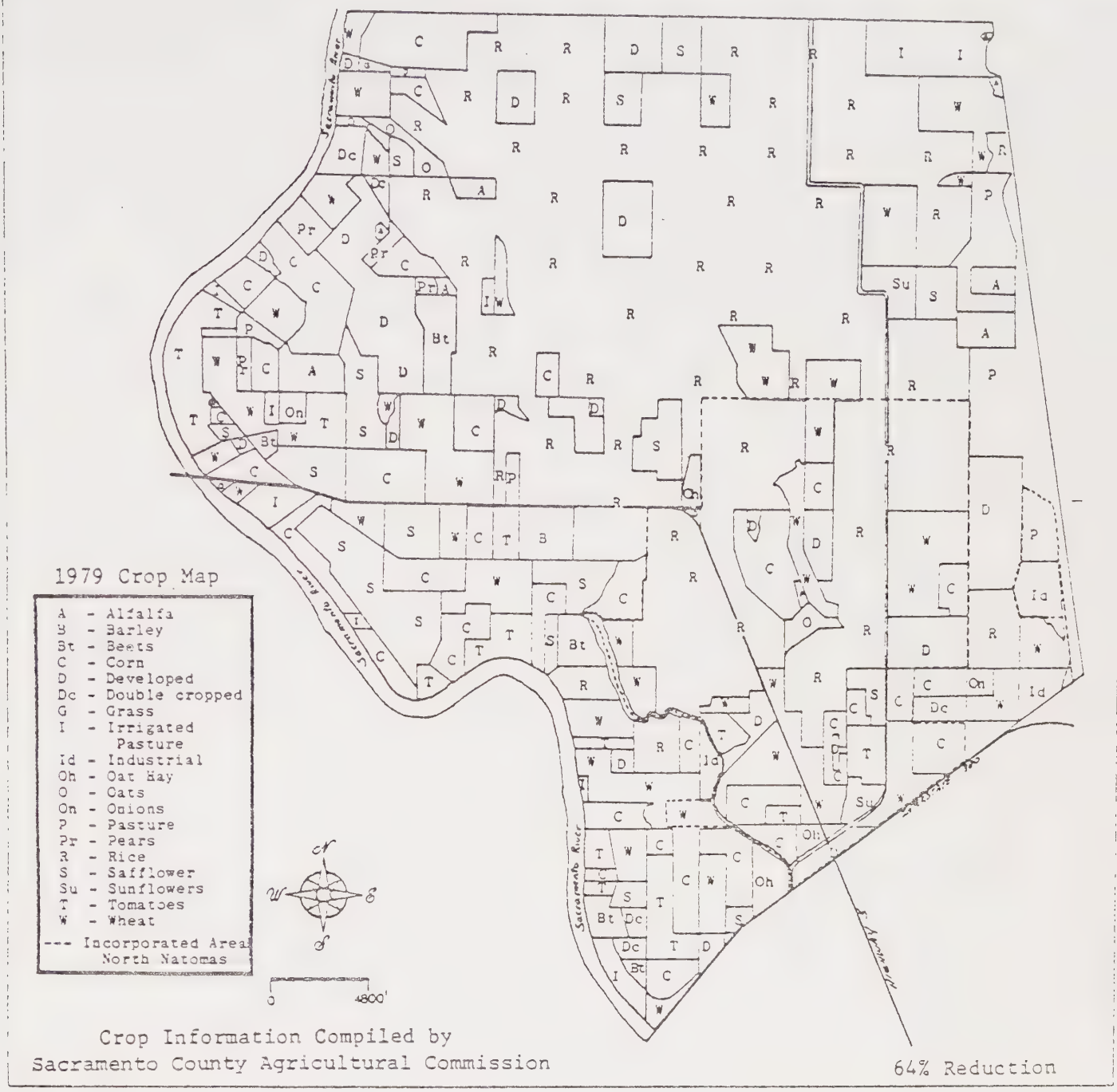


Figure 2

1979 Crop Map
North Natomas Area

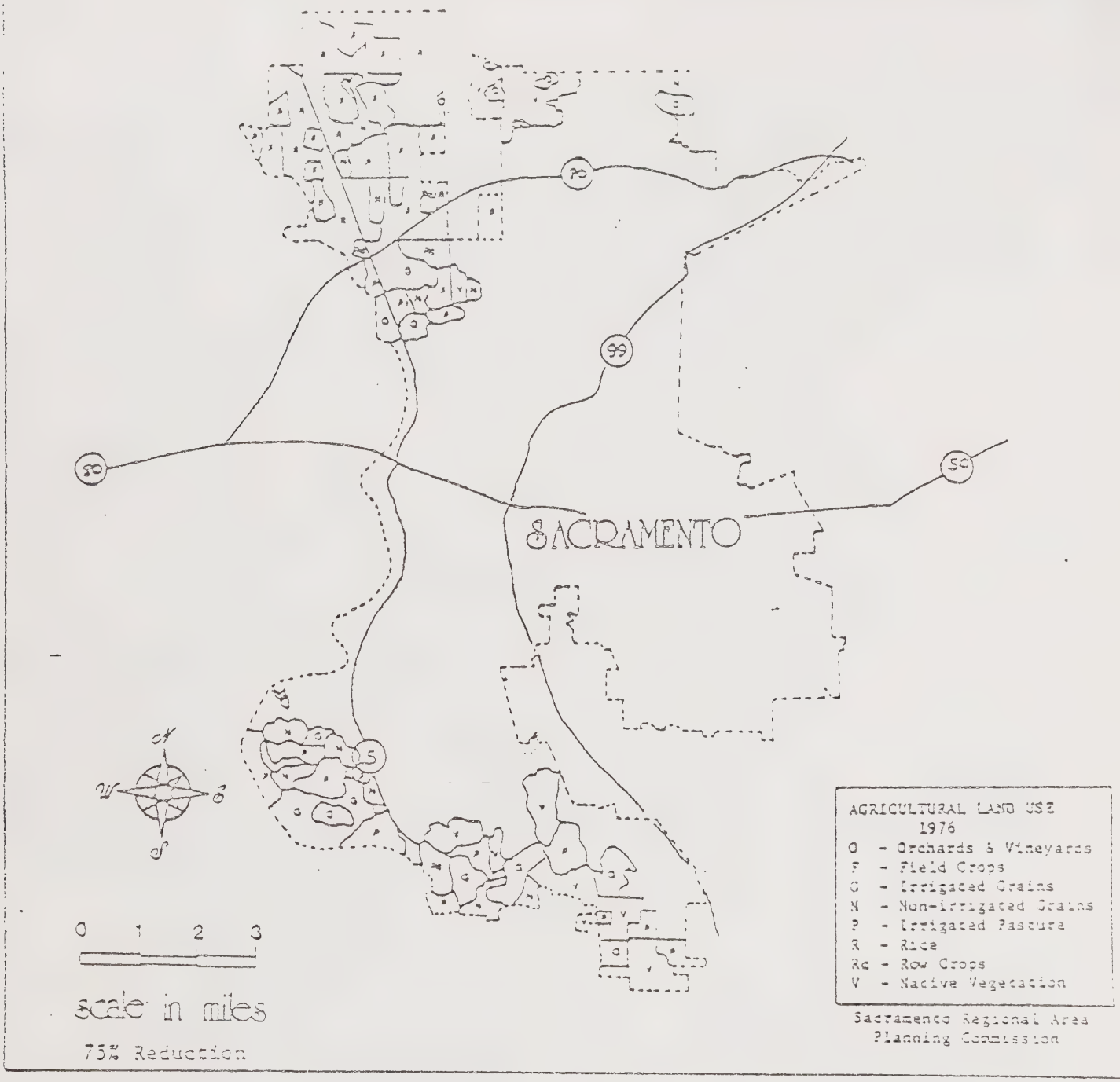


Figure 3

1976 Crop Map
City of Sacramento

Table 11 summarizes the information presented in Figures 2 and 3, showing North Natomas crop acreage as shown in Figure 2 and crop acreage in the balance of the city as shown in Figure 3.

Table 11

Crop Distribution in the City of Sacramento

Crop	North Natomas (Incorporated Portion) 1979 Acreage	Balance of City of Sacramento 1976 Acreage
All Irrigated Field Crops	NT	2,690
Rice	2,950	NT
Wheat	1,260	NT
Field Corn	960	NT
Safflower	70	NT
All Specialty Crops	NT	NT
Tomatoes	230	NT
Orchards and Vineyards	NT	1,490
Dry Farmed Grain	0	1,070
Dry Pasture	140	3,110
Other	80	0
Total	5,690	8,360

NT = not separately tabulated

Source: For incorporated North Natomas figures, see notes to Table 9, p. 15; for city balance, acreages estimated by H. Esmaili & Associates from a 1976 four-county agricultural land use map (unpublished) prepared by staff of the Sacramento Regional Area Planning Commission. Figures shown are net acres (assumed to be 90 percent of gross).

Agricultural land use in the City of Sacramento has changed since 1976. Approximately 4,900 gross acres came out of producton between 1972 and 1980 (see discussion p. 39), or about 553 net acres per year.

In 1979, agricultural land use in the City of Sacramento outside the North Natomas would have dropped from the 8,360 net acres shown in Table 11 to about 6,700 net acres, with total city land in productive agriculture about 12,400 net acres. (These estimates assume that conversion between 1972 and 1980 took place at a constant number of acres per year.) At a net to gross ratio of 0.9 that would mean there were 13,780 gross acres in agricultural use, roughly 23 percent of the city's total land area (down from the comparable 1976 proportion of 26 percent). In 1979, then, agricultural land in the North Natomas accounted for about 10 percent of the city's total land area and about 46 percent of its agricultural land.

In terms of value of production, however, the North Natomas probably represents more than half the city's gross agricultural product. That is because so much of the productive agricultural land in the city outside the North Natomas area is devoted to relatively low value agricultural activities, such as dry grain farming and dry pasture. The vast majority of the North Natomas is suitable for more remunerative types of agricultural production.

The County of Sacramento Compared with Other Agricultural Counties

The North Natomas is the most important agricultural area in the City of Sacramento, and is one of three important agricultural production areas in the county, the others being the Delta and the Southeast. How does county production compare with production in other counties of the crops prevalent in the North Natomas?

The issue is best addressed by a comparison of yields. Table 12 presents comparisons of Sacramento County yields with yields elsewhere in California of the main crops grown in the North Natomas area. Data in Table 12 indicate that Sacramento County yields for wheat and field corn, the second and third most important crops in the North Natomas, are highest in the state. For rice, which is the most important crop in the North Natomas, Sacramento County and two others had yields of 3.1 tons per acre in 1979,

while six other counties had superior yields: Glenn, Colusa, Butte, Sutter, Merced and Yuba. The difference is attributed to the warmer temperatures in the higher-ranked counties, climate - along with basic soil type and management skill - being one of the main determinants of yield.

Yield is not a perfect measure of agricultural productivity since management skill, like soil and climate, may vary from one locality to another. However, viewing the yield data in the most straightforward way, it must be concluded that Sacramento County possesses agricultural resources for North Natomas-type crops which are of statewide significance.

Table 12

Yields of North Natomas Crop Types:
Sacramento County Compared with Other
Major Production Counties, 1979

	Sacramento County		
Crop	Yield (tons per acre)	Rank Among Top Ten Producing Counties	Sacramento County Yield as Percentage of Yield in First-ranked County
rice	3.1	7	91% (of Glenn)
wheat	2.5	1	100%
field corn	4.2	1	100%
safflower	0.9	*	76% (of Fresno)
tomatoes	22.9	9	80% (of Fresno)
sugar beets	24.8	NA	75% (of Monterey)

NA = not applicable (Sacramento County not in top ten)

* Data were available for only five counties and it is uncertain whether they were the top five producers.

Source: California Vegetable Crops 1978-79, California Field Crop Statistics 1979-80, both by California Crop and Livestock Reporting Service, and (for safflower) conversation with Ray Borton of the California Crop and Livestock Reporting Service.

II. ECONOMIC IMPACTS OF NORTH NATOMAS AGRICULTURE

Agriculture in the North Natomas and in other parts of the City and County of Sacramento affects the economy of the region in a number of ways. It provides employment opportunities on the farm - what economists call its "direct" effects. It provides employment opportunities off the farm in other industries which provide goods or services to agriculture - what economists call its "indirect" effects. It provides income to both direct and indirect jobholders, whose expenditures in turn create other jobs and other income in the local economy. Finally, it represents a source of inputs to other sectors of the local economy such that, if local agriculture were to shut down, other sectors of the county economy might find their continuing operations in the county jeopardized.

In this chapter, we will consider first direct employment in agriculture in the North Natomas and the City of Sacramento. We will then estimate secondary employment and overall income from agriculture. We will finally turn to the question of the relationship between agricultural production and the overall regional economy.

ON-FARM EMPLOYMENT

In 1979, the California Department of Employment Development reports that there were 3,000 persons employed in agriculture in Sacramento County in jobs covered by withholding requirements. This number does not include the self-employed, such as farmers, nor does it include unpaid workers, such as members of the farmer's family, whose recompense for farm employment is nonmonetary.

The number of farmers in the county can be estimated from another source: the 1978 Census of Agriculture. Table 13 (p. 23) shows that there were roughly 700 persons operating farms in Sacramento County in 1978 who indicated that farming was their principal occupation. Adding these to the 3,000 agricultural jobs reported by EDD provides a rough estimate of 3,700 persons employed in agriculture in Sacramento County in 1979.

Table 13

Number of Farmers in Sacramento County,
1978 and 1974

Farmer Occupation	Type of Farm	1978	1974
Farmers reporting farming as their principal occupation	All Farms	683	697
	Farms > $2,500 in sales	602	583
Farmers reporting farming as a secondary occupation	All Farms	800	662
	Farms > $2,500 in sales	376	277

Source: U. S. Census of Agriculture, 1978, *Preliminary Report*, Sacramento County. Data for 1974 exclude farms not in individual or family ownership.

It is not possible to determine, on the basis of published data, how direct employment in agriculture breaks down between the City of Sacramento and the county. As a practical matter, some of these 3,700 probably farm both within the city limits and outside. Allocating employment on the basis of agricultural acreage in each area would result in the agricultural employment distribution presented in Table 14.

Table 14

Estimated Agricultural Employment
in Sacramento County, the City of Sacramento
and the North Natomas Area

	Net Acres in Agricultural Use, 1979	Agricultural Employment
County	358,100	3,700
City	12,400	130
North Natomas Area, Total	27,000	280
Incorporated Portion	5,690	60

Source: County and North Natomas acreage figures are from Agricultural Commission *Crop and Livestock Report, 1979* and *North Natomas 1979 Crop Map;* city acreage is from SACOG's 1976 four-county agricultural use map, with areas planimetered by H. Esmaili & Associates and reduced to reflect conversions between 1976 and 1979 (see p. 20). For employment sources, see Table 19, p. 33.

SECONDARY EMPLOYMENT AND INCOME IMPACTS OF AGRICULTURE

Many people who work off the farm hold jobs which are indirectly related to agriculture. Obvious examples include those in veterinary and horticultural enterprises, but many other businesses of all kinds provide goods or services to farms. Data on sales to agriculture by other sectors of the regional economy have been tabulated for a number of California counties for use in economic analysis and forecasting. While such data have not been collected for Sacramento County, data from other counties provides insight into the workings of Sacramento County's economy. Table 15 provides data on Stanislaus County showing, for each dollar of production in the crop indicated, what input from each of the other industrial sectors was required.

Table 15

Direct Requirements for Stanislaus County Agricultural Production, 1974

Sector	*For each dollar of production of these crops, the following purchases are required from other sectors:* corn	wheat	sugar beets	rice	tomatoes
transportation and warehousing	-	-	1¢	-	-
communication and utilities	4¢	3¢	2¢	5¢	1¢
wholesale trade	2¢	1¢	2¢	-	1¢
retail trade	7¢	5¢	4¢	3¢	2¢
finance, insurance and real estate	19¢	12¢	8¢	1¢	4¢
services (including agricultural services)	4¢	4¢	2¢	3¢	3¢
Subtotal	*36¢*	*25¢*	*19¢*	*12¢*	*11¢*
households	33¢	34¢	44¢	59¢	54¢
other sources	31¢	41¢	37¢	29¢	35¢

Source: University of California Cooperative Extension. *Economic Impacts, Stanislaus County.* June 1977.

Purchases from households shown in the table represent the labor costs of production, and also, in the case of farms, any profit to the farmer. The row titled "other sources" includes payments to government (such as local, state and federal taxes) and payments for goods and services from sources outside the region.

The crops tabulated in Table 15, while important to Stanislaus County, are not those for which that county is best known; they were selected for presentation here because they are major crops in the North Natomas. The kind of input/output analysis completed for Stanislaus County has not been performed in Sacramento County. Therefore, reference was made to input/output analyses of several other counties to illustrate the range of secondary economic impacts Sacramento County - and Natomas area - crops have on the Sacramento area.

The secondary impacts consist of the goods and services supplied to agriculture by other local industrial sectors. The greater the proportion of goods and services supplied locally, the greater the secondary economic impact of a given agricultural activity. In Stanislaus, of the crops listed, corn has the greatest secondary impact, with 36 percent of its inputs coming from other local industries in Stanislaus. Tomato production has the least secondary impact, with only 11 percent of its inputs provided by other local industries. Corn, then, has more than three times the secondary impact of tomatoes. A decrease in corn production would have a much greater impact on the local economy than would the same percentage decrease in the production of tomatoes or of rice.

How closely would the secondary impacts of these same crops in Sacramento County correspond to those in Stanislaus? In the absence of an input/output study in Sacramento County, we can draw inferences from input/output studies completed elsewhere. In three other agricultural counties (Fresno, San Joaquin and San Diego) with substantial agricultural services activity, the patterns of first-round interindustry transactions are quite similar: for each dollar of output, agriculture (field crops in the San Diego case) purchases 1-2¢ from transportation, communications and utilities; 2-4¢ from wholesale and retail trade; 3-5¢ from finance, insurance and real estate; 1¢ from services; and 31-38¢ from households. The closeness of these ranges suggests that the pattern of use of local inputs to agricultural production is fairly uniform from county to county, and it would be reasonable to suppose that agriculture's secondary economic impacts in Sacramento County would be comparable to those estimated for other counties.

A convenient way to express the impacts of economic activity is the multiplier: a figure drawn from input/output analysis which is the sum of both the production of a given good and its secondary effects (production in related industries). Table 16 presents the agricultural multipliers of four California counties with their secondary impact components shown separately.

Table 16

Agricultural Multipliers in Four Counties

County	Multiplier (Primary Production and Secondary Impacts)	Secondary Impacts Only
San Joaquin	2.7472	1.7472
Fresno	2.3876	1.3876
San Diego	2.1639	1.1639
Stanislaus*	2.0000	1.0000

* Stanislaus multipliers for various products ranged from 1.5631 (livestock) to 2.3433 (onions); milk ranks first in value of production and has a multiplier of 1.5958. No aggregate multiplier for the entire agricultural sector was calculated, and the estimate here is very rough.

Source: University of California Cooperative Extension, various reports cited in bibliography.

The range of multipliers presented in Table 16 suggests that the agriculture multiplier in Sacramento County is probably greater than 2.0 but is unlikely to be greater than 2.5. A multiplier of 2.35 can be assumed for purposes of estimating agriculture's secondary impacts on Sacramento County. Such a multiplier would mean that, for each dollar of change in agricultural production, there would be an aggregate change of $1.35 in all sectors of the economy (for the purpose of providing goods and services to agriculture, and for supplying inputs to each other for that purpose).

Thus, we can estimate the secondary impacts of agriculture in the county, in the City of Sacramento and in the North Natomas area once we have estimates of the value of agricultural production in each of those areas and an estimate of the local agricultural multiplier. Secondary impact estimates are presented in Table 17.

Table 17

Secondary Economic Effects of Agriculture in the County of Sacramento, the City of Sacramento and the North Natomas Area in 1979

	Total Agricultural Production	Agricultural Multiplier	Total Economic Effects of Agriculture	Secondary Economic Effects
County of Sacramento	$182,800,000	2.35	$429,580,000	$246,780,000
City of Sacramento	$ 5,800,000[1]	2.35	$ 13,630,000	$ 7,830,000
North Natomas Area, Total	$ 13,500,000[2]	2.35	$ 31,725,000	$ 18,225,000
North Natomas Area, Incorporated Portion	$ 2,900,000	2.35	$ 6,815,000	$ 3,915,000

[1] Assumes half of total value of City of Sacramento agricultural production is generated in the North Natomas (see discussion p. 20).

[2] May exclude nursery, dairy and apiary activities (if any) because tabulation by Agricultural Commission staff was directed toward crops.

Source: See sources for Tables 7, 9 and 11.

The estimates of agriculture's economic effects presented in Table 17 are production impacts, and do not reflect the consumer spending resulting from direct and indirect agricultural employment. Consumer spending effects are often estimated by means of a net income multiplier which shows the effects of a given level of economic activity in inducing consumer spending. Consumer

spending multipliers for economic regions generally range between 1.5 and 2.0 (based on direct plus indirect effects) depending on the proportion of consumer demand satisfied by economic activity in the region vs. imports. In the present case, no estimate of the consumer spending effects of agriculture has been prepared, because the alternative use proposed for the chief land at issue here - the North Natomas - is an employment use which would generate consumer spending effects at least as great as those associated with agriculture.

However, an estimate of agriculture-related jobs is important, since those jobs would be immediately affected by a diminution of agricultural activity in the county. An estimate of the number of jobs in non-agricultural industries which are required to produce the inputs needed by the agriculture sector can be prepared by finding out how much of the total secondary production estimate is accounted for by labor costs. In the input/output tables, labor costs are expressed as payments to households. Analysis of the input/output studies completed on San Diego and Stanislaus Counties (where non-agricultural sectors' payments to households are quite close except in trade) suggests that an estimate of 35 percent as the labor costs of production in all sectors supplying agriculture would be a good rough estimate.

If 35 percent of secondary impacts represent labor costs, total income to workers can be readily calculated, and then translated into an estimate of jobs by dividing by average annual earnings. This estimate is presented in Table 18. Comparing secondary agricultural employment in Table 18 with primary agricultural employment in Table 14 suggests that, for each person directly employed in agriculture in the county, there are about 2.2 jobs in other industries providing goods and services directly or indirectly to agriculture.

Table 18

Secondary Employment Effects of Agriculture in Sacramento County, the City of Sacramento and the North Natomas Area in 1979

	County of Sacramento	City of Sacramento	North Natomas	
			Total	Incorporated Portion
Secondary Economic Effects (Value of Production)	$246,780,000	$7,830,000	$18,225,000	$3,915,000
Cost of Labor Input (35%)	$ 86,373,000	$2,740,500	$ 6,378,750	$1,370,250
Number of Agriculture-related Jobs* in Nonagricultural Sectors (Secondary Employment Impact of Agriculture)	8,300	265	615	130

* Based on average annual earnings of $10,400 in all sectors providing goods and services to agriculture. This estimate is the weighted average of 1979 Sacramento County earnings in the following sectors: transportation, communication and utilities; wholesale trade; retail trade; finance, insurance and real estate; and services.

Source: Value estimates from Table 17; earnings data from U. S. Bureau of the Census: *County Business Patterns*, California, 1979.

OTHER ECONOMIC IMPACTS OF AGRICULTURE

Backward Linkages and Forward Linkages

The preceding section combines information drawn from studies of other regions with data from Sacramento County to estimate the total direct and indirect impacts of agriculture on the regional economy. That analysis is directed toward both production in agriculture, and production in other industrial sectors supplying goods and services to agriculture. It represents what economists sometimes call "backward linkages", because it looks back toward the inputs needed to produce agricultural products.

The other major area of agriculture's effects lies in what economists call "forward linkages". That term refers to the industrial sectors that purchase agriculture's outputs. This set of interindustry transactions is not expressed in the kind of multiplier analysis presented in the preceding section.

The difficulty in estimating forward linkages lies in uncertainty about whether firms now using Sacramento County agricultural inputs to their production can readily find other sources of supplies if local sources are eliminated (for example, by conversion of agricultural land). Extensive interviews with Stanislaus County and San Joaquin County food processors in a study of Modesto area agriculture conducted for EPA found that, at least in the short run, representatives of processors there felt they would have no problems finding alternative sources of supply should local production decline.

Agricultural Production and Locations of Agriculture-related Industries

The survival of packing plants in Oakland (in the Fruitvale area, the name of which related to actual land use patterns in the early part of the century), in San Jose and in Los Angeles, at locations increasingly distant from agricultural production, suggests that indeed short term substitution of nonlocal agricultural production would be possible. But Del Monte announced

in 1981 that it would be shutting down Oakland and San Jose plants, and it is clear food processors prefer locations more convenient to their suppliers. The implications for Sacramento County are that as agricultural activity diminishes with continuing urbanization, the desirability of Sacramento locations for the food processing industry will decline. The recent closings of both the Libby and the Del Monte canneries suggests such a decline has already begun; the research required to establish existing conditions has not been done.

Of course, Sacramento offers industries - including food-related industries - a number of advantages aside from that of proximity to agricultural production. In particular, its location offers advantages from a transportation perspective which might, in the view of those in the food-related industries, more than offset disadvantages arising from increasing distances from agricultural production locations. Availability of a local labor force and proximity to various government agencies and services are other local assets. These are some of the reasons offered, for example, by rice millers, who indicate their operations are likely to remain in the county over the long run, even if all rice growing in Sacramento County is eliminated.

The Agricultural Sector in Local Economic Development Strategy

A city whose employment base is heavily dominated by food processing may quite understandably want to diversify its economy: food processing employment varies throughout the year (being greatest at the time of harvest and reaching a low point in mid- and late winter); further, earnings in other kinds of industries may be higher. To a region like Stanislaus County, which regularly sees winter unemployment rates rising to the 14 percent level and higher, diversification seems to promise not only increased economic stability but also improved earnings possibilities for local residents. These factors lie behind the industrialization efforts of agricultural towns like Salinas and Santa Maria in the 1960s and 1970s.

these same towns are now experiencing some of the risks of non-agriculture-related industrial employment: it is not a question of the seasonal slowdown in activity which characterizes food processing, but of the shutdown of entire industrial operations (for example, Firestone in Salinas and Columbia Records in Santa Maria). Industrial development experts, no matter how knowledgeable and prescient they may be, cannot really foretell the long term market conditions that will affect various industries. When agriculture-related employment is exchanged for other kinds of industrial employment, then, the short term benefits may seem clear, but the long term risks are uncertain.

In Sacramento County, the purchasers of agricultural output are probably concentrated in three industrial sectors: manufacturing (especially food and kindred products), transportation and wholesale trade. Table 19 presents the county's employment distribution in 1979. We do not know how dependent these three sectors (and others) are on local agricultural production, but we can say with confidence that some activity in each of these sectors will eventually be lost as agricultural production in the county diminishes. One of the questions facing land use decisionmakers has to do with their willingness to forego existing employment opportunities in order to seek new ones. The loss of local employment is the sum of both the agricultural and related jobs presented earlier in this chapter (Table 14, p. 21 and Table 18, p. 29, respectively) and some undetermined number of jobs from the total presented in Table 19 (p. 33).

Table 19

Sacramento County Employment
by Industry, 1979

	Annual Planning Information, (EDD)	County Business Patterns, 1979 (Bureau of the Census)	Census of Agriculture, 1978 (Bureau of the Census)	Composite Estimate[1]
Total, all industries	320,400	NT	-	329,600
Agricultural	3,000	NT	-	3,700
Covered employment	3,000	NT	-	NT
Farmers	NT	NT	700[2]	NT
Nonagricultural	317,400	NT	-	325,900
Forestry and Fisheries	NT	25	-	-
Mining	200	471	-	500
Contract construction	18,700	19,111	-	19,100
Manufacturing	20,100	21,174	-	21,200
Food and kindred products	5,100	5,703	-	5,700
Transportation and public utilities	14,900	12,786	-	14,900
Wholesale trade	14,200	14,469	-	14,500
Retail trade	61,100	60,801	-	61,100
Finance, insurance and real estate	17,700	18,473	-	18,500
Services	58,100	54,041	-	58,100
Agricultural services	NT[3]	1,037	-	-
Government	112,300	NT	-	112,300

[1]The composite estimate by Mundie & Associates uses the EDD figures when they exceed those reported in County Business Patterns because the latter source excludes proprietors, self-employed individuals and government employees. Figures are rounded to the nearest hundred.

[2]The 1978 Census of Agriculture reported 683 individuals whose primary occupation was Sacramento County farmer.

[3]Veterinary services (074), other animal services (075) and landscape and horticultural services (078) are tabulated in the services category. All other agricultural services are tabulated under agricultural.

III. PLANNING FARMLAND: THE BROADER ISSUES

FARMLAND CONVERSION TRENDS

Increasing attention to farmland resources at the national, state and local levels of government has resulted in an intensive review of the extent and causes of loss of agricultural lands. Land use analysts contributing to the National Agricultural Lands Study concluded, based on their review, that the United States has a sufficient supply of agricultural land to accommodate domestic and foreign demand for food and fiber through the end of the century. These overall conclusions are accompanied by expressions of concern about continued losses of certain kinds of agricultural land resources and the difficulties of replacing them.

A brief overview of the conversion issue at the national, state and local level is provided below. The interested reader can pursue this subject further by consulting Appendix C.

National Perspective

The major sources of irreversible agricultural land loss are construction of urban, transportation and water impoundment facilities. Analysis by the National Agricultural Lands Study (NALS, 1981) found that about 675,000 acres of cropland were converted to such uses annually over the eight-year period from 1967 to 1975. This represents 0.0012 (just over one-tenth of one percent) of the total cropland and potential cropland recorded in a 1977 national inventory by the Soil Conservation Service.

Contributing to the loss of farmland nationally have been a number of factors. Construction of the interstate highway system resulted in the direct loss of land to highway use, and has been a factor in the decentralization of jobs and population witnessed in the 1960s and 1970s. Both urban growth and the expansion of irrigated agriculture have encouraged development of water resource projects, which also have involved irreversible loss of farmland.

Finally, human settlements - whether taking the form of urban expansion, of recreational subdivisions, or of development of rural land for habitation - have accounted for the largest share of irreversible conversion of agricultural land.

How far into the future will the 1967 to 1975 conversion rate extend? USDA staff members contributing to the National Agricultural Lands Study believe that the rate of conversion will decline in the remaining years of the century, for several resasons. They point out that the interstate highway system has been virtually completed, and that reservoir construction will be at a lower level. State highway construction dropped considerably from the 1960s to the 1970s. The demand for housing is expected to drop because the rate of new household formation will decline sharply after 1985.

In rural areas, the increasing availability of nonfarm jobs - a result of the economic decentralization of the past two decades - is seen as having two offsetting effects. On the one hand, the new enterprises locating in rural areas consume land for their physical plants, for access and utilities facilities, and for other related land uses. On the other hand, many of the new rural jobs are held by members of farm families whose contribution to family incomes is seen as helping farm owners to maintain their land ownership.

Two principal conclusions were drawn by NALS staff who looked at the national agricultural land supply: first, that a continuation of the historic rate of conversion would not pose a crisis; and, second, that the future rate will probably be lower than the recent historic rate. But their research also indicated a number of factors suggesting caution. These factors are more clearly recognizable at the state and local levels.

California Perspective

California is an important producer of staple food and fiber crops such as wheat, field corn, cotton, sugar beets, livestock and poultry, but the most

distinctive feature of farm production in the state is the abundance and variety of its "specialty crops": a classification which includes fruits, nuts and berries; vegetables, sweet corn and melons; and nursery and greenhouse products. In 1974, California was the leading state in the production of 58 commodities, and accounted for over 90 percent of U. S. production of 12 crops (Reed, 1977).

The preponderance of the acreage in specialty crops, both in California and nationwide, is in metropolitan areas. Table 20 presents data on two regions, Pacific and Northeast, which together provide almost 40 percent of the nation's specialty crops.

Table 20

Specialty Crops Grown in the Northeast and Pacific States: Proportion Grown in Metropolitan Counties, 1974

	Northeast[1]	Pacific[2]
Percent of All Commodities Sold Produced in Metropolitan Counties	46.1	56.1
Percent of Specialty Crops Sold Produced in Metropolitan Counties	71.0	70.5

[1] Ten states: Maine, New Hampshire, Vermont, Connecticut, Rhode Island, New York, Pennsylvania, New Jersey, Delaware, Maryland.

[2] Three states: California, Oregon, Washington.

Source: NALS, 1981, p. 47.

This pattern of concentration of specialty crops in and near urban centers is of long standing. Formerly, perishable crops had to be grown close to markets, and therefore tended to be found near cities. The long period of migration to the Sunbelt which the nation has experienced in the 20th century has increased the populations of areas possessing climatic conditions particularly suited to specialty crops. Finally, specialty crops make

intensive use of the land, resulting in higher returns per acre than most other kinds of agricultural activity, thereby permitting farmland owners to resist urbanization pressures longer.

In looking at the nation's supply of land suited to specialty crop production, California's resources are particularly important for two reasons. First, many specialty crops are grown here which are not grown elsewhere in the United States, and for which other areas of the country are not suitable. The depletion of California's resources for specialty crop production would mean that, to continue to supply domestic demand, the nation would have to import those foodstuffs from abroad.

Second, California is closer to the exhaustion of its farmland reserves than most other states are. NALS staff analyzed the SCS National Resources Inventory (the 1977 inventory of farmland resources) and found that, in the three Pacific states, potential cropland - land inherently best for agriculture and with a high or medium economic potential for cropland use - represented a lower proportion of existing cropland than in all other regions of the country with the exception of the Great Lakes and Corn Belt states. The small scale of the reserve compared to the amount of land in use for crop production means that opportunities for substitution are limited, while the location of specialty crop production in metropolitan areas means that specialty crop land is particularly desirable for nonagricultural use.

Third, substitution is also limited, in California, by water availability. Some of the potential cropland lacks present water resources, and the prospects for major new water projects are dim. The rate of growth of irrigated acreage in the West, which has been high in the last three decades, is leveling out, in part because, compared to past water projects, new projects are both more costly (and are evaluated in terms of economic, social and environmental costs which often were not considered in earlier water resource projects in this century) and less productive (because the optimal sites for impoundments have already been used).

Fourth, some of California's farmland is characterized by unique microclimatic conditions. A good example are hillside growing areas in San Diego County, where cold air drainage permits cultivation of pole tomatoes, grapes and other crops for which valley floor growing conditions would be too cold. The state does not presently have an inventory of present or potential farmland with localized climatic features suitable to particular specialty crops, so substitution opportunities are uncertain.

Finally, substitution of potential for current cropland, in California and elsewhere, must take into account what alternative productive use is foregone on the substituted land. The principal region of the nation which seems to offer the greatest potential for bringing new cropland into production is the Southeast. But the same land which is considered by farmers as suitable for cropland development is being eyed by other interests for expansion of grazing lands and expansion of commercial forest lands. This conflict among existing and potential resource uses of land is one of the key aspects of the substitution issue.

Work conducted for EPA and reported in the EIS on the Modesto wastewater facilities plan (EPA, 1979) found that the agricultural land inventory in California was so inconsistent and fragmentary that reliable estimates of an agricultural land conversion rate could not be developed. Recent comments by the office of Assemblyman Richard Lehman (Sacramento Bee, January 8, 1982) and consultations with staff of the Office of Planning and Research indicate that this situation is unchanged since the Modesto work was completed. The conclusions of that study, regarding California, remain valid:

> In summary, it appears that, although an adequate supply of potentially arable land exists in the state, the quality and economic viability of farming on these lands is not necessarily equivalent to those of the prime lands that are currently being lost to urbanization. Under these conditions, selection of a cautious approach with regard to farmland conversion would be highly advisable.

California's Department of Conservation has begun a program of important farmlands mapping and monitoring. That program, statutory authority for which is anticipated with enactment of AB 966, will greatly improve the state's ability to monitor its farmland supply.

Sacramento Perspective

Both the City of Sacramento and Sacramento County experienced extensive conversion of agricultural land to urban use in the 1970s. Inspection of satellite photographs indicate that major agricultural land losses have taken place in the most important agricultural sections of the city between 1972 and 1980. These are the Natomas, the Pocket Area and South Sacramento. Figure 4 (p. 40) shows the area converted during this period, and Table 21 presents estimates of acreage converted.

Table 21

Agricultural Land Converted to Urban Use,
City of Sacramento, 1972 to 1980

Area	Total Gross Acres Converted	Average Net Acres Converted per Year
South Natomas	1,017.5	114
Pocket Area	2,039.5	230
South Sacramento	1,858.6	209
Total	4,915.6	553

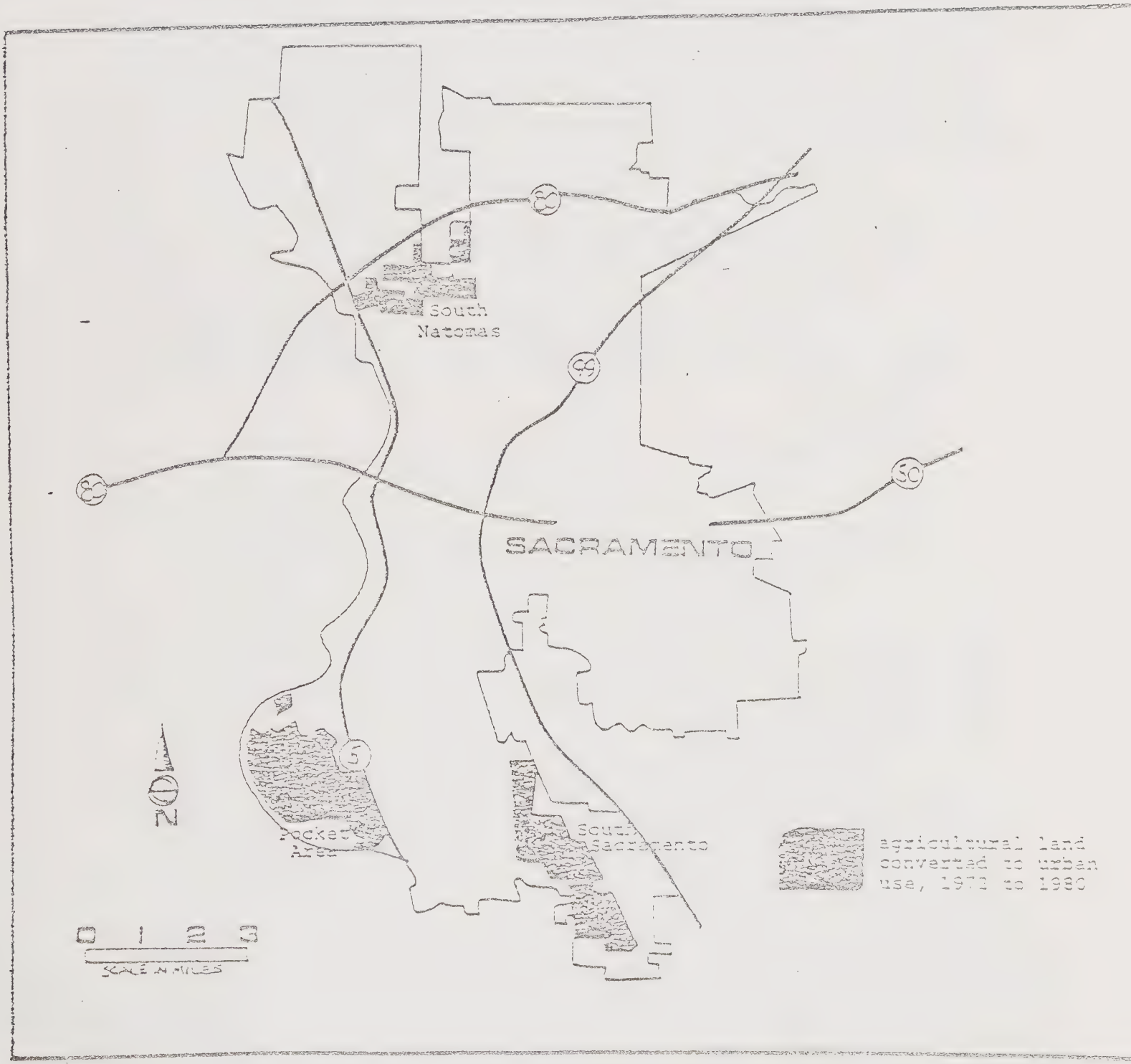
Source: Sacramento City Planning Department, unpublished data from review of Landsat infrared photographs, January 1982.

The figures presented in Table 21 do not reflect the total acreage converted, because only the major agricultural areas were considered, and scattered parcels elsewhere in the city were omitted.

Comparable data for the County of Sacramento are lacking. However, reports of the U. S. Bureau of the Census in the 1974 and 1978 Censuses of Agriculture indicate that land in farms declined substantially between 1969 and 1978: from about 518,000 acres in 1969 to 448,000 acres in 1974 to 434,000 acres in 1978. While there may be a variety of reasons for the decline, urbanization certainly was an important cause of farmland loss in Sacramento County in the 1970s.

Figure 4

Agricultural Land Converted to Urban Use
City of Sacramento, 1972 to 1980



SUBSTITUTION: OPPORTUNITIES AND RESOURCE COSTS

When a local government considers the possibility of opening an agricultural area to urban use, one of the issues which often arises has to do with the availability of other lands which could be brought into cultivation to "substitute" for the agricultural land proposed for conversion. The substitution issue has several aspects: the availability of untilled land which could be brought into cultivation, the quality of that land as compared with the land proposed for urbanization, and the potential costs of establishing agricultural use, or intensifying an existing agricultural use, on the substitute lands.

Availability of Substitute Lands for the North Natomas

To address the question of whether substitute lands are available in the event the North Natomas is urbanized, information was compiled for the three counties nearest the study area - Sacramento, Sutter and Yolo - on agricultural land use patterns. The findings are summarized in Table 22 (p. 42) which shows acreages of tilled and fallow land, irrigated and non-irrigated, in the three counties in 1976.

In addition, data were tabulated for Sacramento and Yolo Counties on land acreages by capability class; these data, presented in Table 23 (p. 43), provide insight into the quality of potentially substitutable areas.

Taking data in both tables into account, the 1976 situation can be summarized as follows:

- In Sacramento County, 231,500 acres of land were under cultivation and 10,000 acres were in fallow condition. The total acreage of class 1, 2 and 3 lands in this county is 161,200. Comparison of these two numbers shows that at least 80,300 acres of class 4 lands (and probably a much higher acreage) were cropped in the county in 1976.
- In Yolo County, 351,100 acres were under cultivation and 32,462 acres were in fallow condition in 1976. The total acreage of Class I, II and III lands in Yolo County is 358,569. Comparison of these numbers shows that potentially 25,000 acres of Class IV soils may have been cropped in Yolo County in 1976.

Table 22

1976 Land Use Summary for Sacramento, Sutter and Yolo Counties
(acres)

Land Use Type	Sacramento County				Yolo County				Sutter County			
	Irrigated Land		Non-Irrigated Land		Irrigated Land		Non-Irrigated Land		Irrigated Land		Non-Irrigated Land	
	Tilled	Fallow	Tilled	Fallow	Tilled	Fallow	Tilled	Fallow	Tilled	Fallow	Tilled	Fallow
Grain and Hay Crops	46,838	533	14,284	6,097	76,207	71	21,739	21,188	32,248	1,839	7,425	1,080
Rice	11,917	0	0	0	20,705	0	0	0	81,901	3,165	0	0
Field Crops	66,811	2,533	0	0	108,974	10,544	823	350	45,648	2,620	0	0
Pasture	64,961	0	11	0	30,447	0	128	0	17,573	137	31	0
Truck and Berry Crops	9,516	0	0	0	63,207	203	0	13	34,007	65	0	0
Deciduous Fruits and Nuts	8,609	0	616	0	23,043	76	1,983	27	57,294	373	50	0
Subtropical Fruits	41	0	96	0	64	0	0	0	53	0	0	0
Vineyards	3,204	0	4	0	780	0	17	0	34	0	0	0
Semiagricultural (farmsteads, feedlots, dairies, lawn, cemeteries)	1,646	0	2,949	0	691	0	2,328	0	107	0	1,447	0
Idle land:												
a. Cropped in recent 3 years	1,919	-	-	-	986	-	0	-	-	-	1,144	-
b. New land coming into production	-	-	539	-	-	-	3,427	-	589	-	-	-
Double cropped land	5,987	0	0	0	1,014	0	250	0	19,780	0	0	0
Native Vegetation	-	-	249,331	-	-	-	237,584	-	-	-	55,963	-
Riparian Vegetation	-	-	4,008	-	-	-	998	-	-	-	11,661	-
Water Surface	-	-	19,486	-	-	-	6,680	-	-	-	4,458	-
Urban	-	-	112,882	-			19,252	-	-	-	8,554	-
Miscellaneous		-	395	-	-	-	-	-	-	-	20	-
Total	221,449	1,066	404,603	6,097	326,118	10,894	295,209	21,578	289,234	8,399	90,753	1,080

Source: State of California, Department of Water Resources. Unpublished data tabulated by H. Esmaili & Associates.

- In Sutter County, 277,800 acres of land were cropped and 9,500 acres were under fallow condition in 1976. [No data are available on the acreage of soils by capability class in this county.]
- The acreage of tilled fallow land in 1976 was 2,000 acres in Sacramento County, 1,000 acres in Yolo County and 1,100 acres in Sutter County.
- The acreage of nonirrigated new land coming into production was 500 acres in Sacramento County and 3,400 acres in Yolo County. About 600 acres of irrigated new land were being brought into production in Sutter County.
- In all three counties the balance of the total acreage was under native vegetation, urban use, riparian vegetation and water surface areas.

Table 23

Land Acreage by Capability Class for Sacramento and Yolo County Areas

Sacramento County		Yolo County	
Capability Class	Acreage*	Capability Class	Acreage
Class 1	38,495	Class I	102,164
Class 2	61,075	Class II	160,128
Class 3	61,630	Class III	96,277
Class 4:		Class IV:	
0-1% Slope	162,351	0-1% Slope	82,997
3-8% Slope	96,129	2-50% Slope	51,077
2-15% Slope	77,114	Class VI	71,664
Class 5	27,829	Class VII	56,840
Class 6	37,809	Class VIII	40,613
Total	562,432	Total	661,760

* Exclusive of about 47,000 acres of Class 1 and 2 soils in the Delta area.

Source: For Sacramento County, SCS, 1954; for Yolo County, SCS, 1972; compilation by H. Esmaili & Associates.

The data presented in Tables 11 and 12 suggest that the conversion of agricultural land in the North Natomas probably cannot be substituted by bringing into cultivation soils in the three-county area of comparable quality. Virtually all such soils are already in cultivation:

- In Sacramento County, it is highly improbable that any significant acreage of Class 1, 2 or 3 land remains idle. On the contrary, a significant acreage of poorer quality Class 4 soil is currently in production. Therefore, the probability of replacing agricultural lands in the North Natomas with equal acreage of similarly productive soils within the county is extremely low.
- In Yolo County, all Class I through Class III soils and an appreciable acreage of suitable Class IV soils appear to be under cultivation. Again, the probability of finding suitable replacement acreage for the North Natomas area would be minimal.
- In Sutter County, existing crop acreage comprises about 78 percent of the county land. About seven percent of the land is in urban use, riparian vegetation, or water bodies. The balance is in native vegetation. It is unlikely that significant arable acreage in this county is idle.

There may be substitution possibilities at greater distances. For example, the extension of the Tehama-Colusa Canal is expected to make a substantial acreage available for cultivation of typical central Sacramento Valley crops. Other substitution possibilities include bringing more of the state's poorer soils (Class IV) into cultivation. Certain of those soils are capable, with appropriate management practices, of growing the kinds of crops that are currently grown in the North Natomas. The principal barrier to transforming potential cropland into productive cropland is cost.

Costs of Substitution: What the Farmer Pays

When a farmer brings land into agricultural production, he incurs both capital and operating costs. Capital costs of land development may include land preparation (such as leveling, removing rocks, deepening root zones, and so forth), construction of irrigation and drainage facilities, and provision of water. The farmer's operating costs will reflect the quality

of the soil resource at his disposal and the extent to which capital improvements are able to reduce inherent soil quality limitations. At this time, interest rates on capital borrowed to finance capital improvements and on production loans have attained a prominent position on the farmer's balance sheet.

In order to help determine the magnitude of the cost involved in transferring agricultural production from a relatively fertile area to an area of poorer soil quality, production cost data were sought from North Natomas farm operators and from their counterparts in the Southeast County area. Their data on 1980-81 production costs for typical North Natomas crops are presented in Table 24 (p. 46). The costs include only what the farmer actually pays to plant, maintain and harvest a given crop; land and non-cultivation management costs are excluded. Table 24 also shows the differences in yields experienced by the farmers, and the resulting differences in cost per unit of output.

The data presented in Table 24 provide a measure of the superiority of North Natomas land over farmlands in the Southeast County area: yields are consistently higher, and direct production costs per unit of output consistently lower. Since the kinds of new lands capable of being brought into cultivation in California resemble the Southeast area more closely than the Natomas, this illustration is a first step in understanding the costs imposed by the loss of the kinds of agricultural resources the North Natomas has to offer. However, this cost estimate is incomplete since it represents only the farmer's operating costs. It should be noted that the capital cost of developing Southeast Area lands (or other similar lands elsewhere) for agriculture are not included in Table 24.

Resource Costs

In addition to the farmer's out-of-pocket costs for bringing land into production and cultivating it, there are resource costs of substitution which also must be taken into account. Earlier in this chapter, it was mentioned that land in the southeastern part of the United States which is considered

Table 24

Production Costs for North Natomas-Type Crops:
North Natomas Farmland Compared with Southeast
Sacramento County Farmland

Crop	Production Unit	Yields per Acre		Direct Production Costs[1] per Production Unit	
		North Natomas	Southeast County	North Natomas	Southeast County
Rice	100 lb. bag	80	55	$ 4.56	$ 5.90
Wheat					
Field Corn	ton	5	3.75	$77.50	$68.21
Processing Tomatoes	ton	35	20	$18.70	$26.45
Sugar Beets[2]	ton CWT	35 50	25 38	- $10.79	- $13.21
Alfalfa	ton	6	5	$69.92	$90.00

[1]Excludes land and management costs and profit. Data were provided on a per-acre basis for 1980-81.

[2]Sugar beet prices are per ton of bulk beets on a sliding scale according to the percentage of sugar. For beets with 14 percent sugar (North Natomas) the price is $37.17 per ton of beets; for 15 percent (Southeast) the price is $39.87. This price differential reflects the lower processing costs associated with higher sugar concentrations. Cost per production unit has therefore been calculated in terms of hundred weight (CWT) of sugar produced.

Source: Data supplied by individual growers, tabulated by Mundie & Associates.

to have a high potential for development as cropland is also considered to have a high potential for use as grazing land and for use as commercial forest land. To satisfy one objective means foregoing another objective.

In the case of finding substitute cropland for North Natomas land that might be converted to urban use, the lands which seem most likely to be developable in North Natomas-type agriculture are now irrigated pasture lands. What must be understood is that, to develop such lands for the production of rice or wheat (or whatever), their use as grazing land is terminated. The implications of such a change are that either (1) other lands must then be substituted for the grazing land lost, or (2) feed lots must be substituted for grazing (in turn requiring expanded cropland use for feed grain production), or (3) meat consumption must be reduced, or some combination of these.

The fact that soils of inferior quality are associated with lower yields increases the magnitude of the problem of finding substitutable lands, because more substitute land is needed to maintain equivalent production levels. The first column in Table 25 (p. 48) shows how much land in the Southeast Area would be needed to achieve the North Natomas production levels of various crops.

SUBSTITUTION: CONSUMER COSTS

The agricultural value of land ultimately reflects the price which a food or fiber crop commands in the marketplace, a price consumers influence through their numbers, their appetites and their preferences. When farmland is purchased for nonagricultural use, its agricultural value, and the contribution consumers make to the determination of that value, ceases to be relevant.

But consumers can experience increased costs as a result of conversion. Unfortunately, by the time conversion has taken place, it is not possible for rising food prices to bid converted land back into agriculture. Conversion to urban use is, for all practical purposes, irreversible.

Table 25

Some Implications of Substituting Southeast Area Land for North Natomas Agricultural Land

Crop Type	Southeast Area Acreage Needed to Achieve Production of One Acre in North Natomas (acres)	Producer Cost Increase in Shifting Production to Land of the Type Found in the Southeast Area (percent)	Producer Share of Consumer Prices[2] (percent)	Increased Consumer Costs Associated with Substitution[3]
Rice	1.46	29	15	?
Wheat			15	?
Field Corn	1.33	14	37	?
Tomatoes	1.75	41[1]	18	?
Sugar Beets	1.31	22	37	?
Alfalfa	1.20	29	37	?

[1]Only one grower in the Southeast Area outside the Cosumnes River area was found to be growing tomatoes.
[2]Percentages given are for the following categories: cereals and bakery products for rice and wheat, processed fruits and vegetables for tomatoes, and the market basket average for the other crops.
[3]An increase may be experienced, but no attempt has been made to quantify it, for reasons explained in the text.

Source: Table 24 and USDA, Agricultural Outlook, November 1981.

The possibility that urban conversion of good quality farmland may result in increased consumer costs is normally not taken into consideration when farmland is converted. Such possible cost increases are overlooked or discounted for a number of reasons. First, costs are difficult to determine and to quantify; furthermore, the producers' share of total consumer costs may be small (see Table 25). Second, the cost increase may not be realized at the same time as the conversion. Third, the local government has no direct responsibility to the general body of consumers (as opposed to local voters).

The case of the North Natomas is probably very similar to urban conversions of agricultural land elsewhere in California: the main substitution alternatives involve lower quality soils and higher production costs. Although production costs in the Southeast Area are higher, growers everywhere all receive the same price. If the balance of crop production were to shift from Class II and III to Class IV soils, it will increasingly become possible for producers using inferior lands to pass on their higher production costs, because a declining proportion of total production will derive from lands having lower production costs.

Thus, while conversion of the North Natomas per se cannot be expected to influence how much consumers will have to pay for a loaf of bread, a bowl of rice or a steak, the cumulative effect of many such conversions would tend to push consumer prices higher. Sustained international demand, the depletion of domestic surpluses and continued increases in energy costs* would all work to make consumer cost increases resulting from conversion of better agricultural lands happen sooner rather than later.

* In agriculture, energy costs are reflected in water costs (because of pumping), in fertilizer and chemical costs (many of these products are derived from petroleum) and in fuel costs for farm machinery.

The estimation of the many factors between farm and table which influence food prices is beyond the scope of this work. Hence the question marks in the last column of Table 25. But the principle involved is too important to be dismissed from consideration: when a superior production factor is foregone, eventually the lost production advantage will be reflected in higher consumer costs.

IV. THE FUTURE OF THE NORTH NATOMAS

The purpose of this study is to investigate the status and impacts of agriculture in the North Natomas and to explore the future of agriculture in this part of Sacramento County. Among the issues that affect the future of agriculture are land prices and ownership patterns and how landowners and farmers see their agriculture opportunities, in the short and long run, in comparison with opportunities to develop the land for other uses.

The first three chapters of this report have described the current status of agriculture in the North Natomas, and the relationship of local agriculture to the economy. In this chapter, the concern is with the future of the North Natomas.

The first part of this chapter considers the long-term prospects of agriculture in the North Natomas under the assumption that land use regulations will support that use. The second part of the chapter treats one of the forces which both creates, and results from, urban conversion pressures: reported increases in land values. The final section of the chapter identifies many of the factors which decisionmakers will want to consider in reviewing the appropriateness of existing planning and zoning designations for the North Natomas area.

NORTH NATOMAS AGRICULTURE: A LOOK AT THE FUTURE

Agricultural use patterns in the North Natomas have, in the past, tended to remain fairly stable over periods of a decade or more. Changes have arisen primarily due to fluctuations in market conditions, but have not involved a radical departure from the basic crop mix in the area, which has historically been dominated by field crops (such as grains) with a small but significant proportion devoted to row crops (such as tomatoes). At present, rice is the principal crop, accounting for 82 percent of Sacramento County's rice acreage (see acreage summary in Table 9, p. 15). Other important crops are wheat, corn, safflower, processed tomatoes and sugar beets.

Resource Factors Influencing the Crop Mix in the North Natomas

While yearly variations in crop mix are due primarily to market conditions, there are basic determinants of crop mix that are relatively unvarying. These include soils, water supply and climate.

Soils in the incorporated portion of the North Natomas are primarily Class II (80 percent) and Class III (17 percent) (see Table 3, p. 6 for a detailed inventory). These soils are reported to be very consistent throughout the area (Moore, personal communication), and are most suited for small cereal grains, milo, alfalfa, rice, corn and, in some cases, sugar beets. The absence of fruit trees and nuts and most row crops reflects the character of the soil resource, which basically precludes deep-rooted crops.

Water availability and quality do not pose constraints to crop choice in the area; the available supply with recycling (see Appendix D) permits the cultivation of water-intensive crops such as rice.

The climate is suitable for the current mix of crops. Sacramento County's combination of soils, water availability and climate result in its having the highest wheat and field corn yields in the state. However, climate is a limiting factor locally in at least two respects: summers in the North Natomas are not quite as hot as they are elsewhere in the state or even elsewhere in the county; this results in lower rice yields than are obtained in counties farther north in the Sacramento Valley (see Table 12, p. 21) and lower tomato yields than the county average (see Table 10, p. 16).

The second limitation posed by climate is on the feasability of double-cropping. The only double-cropping that is possible in the North Natomas is for forage crops, such as oats. The growing season is not long enough to permit two crops to reach maturity before harvest. If the winter crop is permitted to reach maturity, there is not enough time left in the growing season to plant and harvest a second crop. Therefore, double cropping must be limited to forage crops which can be harvested green.

At present, there are approximately 75 Grade A dairies in Sacramento County, and most of these supply their own forage crops. The market for such crops is saturated at this time, and current double-cropping in the North Natomas is believed to be the maximum supportable by the market. Double cropping of other-than-forage crops is not feasible.

Other Factors Influencing Crop Mix

Aside from market and resource factors, there are other influences on crop mix. One of these is the labor supply. There has been a decline throughout California in the cultivation of labor-intensive crops in recent years due to reduced labor availability and increased labor costs. The relatively low labor cost of rice is one of the important features encouraging its growth in the North Natomas, while asparagus, which has been grown there in the past, is being passed over because of labor conditions.

A second factor is simply that, when a new and potentially lucrative crop is introduced, there may be a sudden shift in production patterns such that the market quickly becomes saturated. This has happened in Sacramento County with onion seed: so much acreage was planted that the price dropped and the crop quickly became less lucrative.

The cultivation of a new crop may also entail unforeseen problems. An example is wild rice. Controlling birds proved to be more of a problem than had been anticipated, driving up pest control costs and thereby reducing the return to the grower.

Potential Changes in Yields

In the past two decades, average rice yields in California have increased from one-and-one-half tons per acre to over three-and-one-half tons per acre (USDA, July 1981). A rate of increase of that magnitude is not generally expected to persist, but some increases will continue to be experienced through a variety of techniques possibly including genetic

engineering. Future yield increases in rice cannot be totally discounted given the record of technological improvements of the past decades. Some improvement in the yield of other crops grown in the North Natomas can also be expected in the long term under optimal management conditions.

Present Crop Pattern Appears to Be the Most Appropriate Given Current Conditions

Farmers, like other business people in a free economy, make an effort to obtain the best return they can from the resources at their disposal. Like other business people, they may occasionally miscalculate (see p. 58 for a discussion of the low participation in Williamson Act contracts), but most of the time they try to farm their land in the most economical way given the applicable set of resource constraints, their own management ability and, when given a choice, their preferences.

Observers of cultivation patterns in the North Natomas generally agree that the current pattern is about the best that can be arrived at under current circumstances: "The farmers are doing the best they can with what they have to work with", is the way staff of the Extension Service put it. The duration of continuous cultivation in the area strongly suggests that long term cultivation of crops suitable to the area can continue indefinitely, given good farm management, though year to year profitability may vary, as is true in any industry. The continued excellent water supply and the ability to continue normal agricultural practices (eg., burning of rice straw) will ensure the maintenance of conditions suitable for agricultural production throughout the foreseeable future, assuming land use regulations are consistent with that purpose.

THE NORTH NATOMAS LAND MARKET

At present, some North Natomas landowners advocate a change in area zoning to permit urban development. Recent changes in the area land market, and in particular the prices at which land has changed hands in some transaction, have raised doubts in some minds that continued agricultural use can be sustained. In this section of the chapter, information bearing on that issue is presented.

Agricultural interests who already own land and wish to expand their holdings are limited in the amount they can pay for land by the agricultural income they can expect the land to produce. (See Appendix E for a discussion of valuation based on capitalization of income.) Anyone purchasing agricultural land for purposes other than agriculture (say, for industrial development) bases his purchase price, not upon returns from agriculture, but on returns from that alternative use, discounted (according to the buyer's level of optimism) to reflect the cost of obtaining necessary changes in the community general plan, the zoning ordinance and whatever else must be altered prior to receiving development approvals, and also to reflect the risk that those changes will not be made and that conversion of agricultural land will either not be permitted or will be delayed beyond the buyer's preferred schedule.

The investigation of the North Natomas land market conducted for this study looked at land values in the area from two perspectives: first, research into land market behavior of agricultural land owners in the region, and second, interviews with knowledgeable people involved in the local land market, supplemented by an analysis of sales prices in recent transactions as reported in the records of the County Assessor.

Urbanization of Farmland: A Theoretical Model

Land Market Pressures on Urban Fringe Land

Most urban communities tend to expand outward even if population in the central area is declining. For one thing, it is easier in many ways to replace obsolete urban infrastructure and buildings with new suburban construction than with new construction or renovation in the older urban area. For another, there is an "income-elastic" demand for urban land, meaning that urban land per capita tends to rise as income rises, so that even a city of constant population is likely to spread out. Because urbanization generally carries with it increasing returns to scale, urban users can outbid agricultural producers for fringe land.

This thumbnail description of why nonfarmer investors begin to buy agricultural land at the urban fringe seems to suggest that the value of fringe land is the higher of capitalized agricultural returns and an urban value adjusted for the outlying location. In fact, the value of fringe land is a bit more complex than that. The prospect of development means the land's value is the sum of capitalized agricultural net income over a "holding use" period plus the present value of the price that a future developer will pay. Both of these components are subject to further complications. The prospect of development alters the economics of agriculture in at least three ways:

- Upward revaluation of farmland means that the farmer's capital investment grows, enlarging the opportunity cost charge against farm receipts and lowering farm labor income.
- Out-of-pocket operating costs may be substantially increased by property tax reassessment based on sales of some farm parcels to nonfarmer investors.
- Agricultural operations may be hampered by encroaching urban activity, such as restrictions on pesticide use or on burning or by automobile-caused air pollution, industrial wastes, etc.

Meanwhile, the present value of future development use is also uncertain because:

- The time when the land is "ripe" for development cannot be predicted with accuracy as it depends on changes in the urban community's economic base, directional growth trends and cyclically fluctuating credit conditions.
- Local government must sanction development and provide for extension of infrastructure, and these circumstances cannot be assured.

Under these conditions the owner of fringe land is tempted to accept a firm offer from an investor or developer who is willing to bear the substantial risk. The investor or developer, for his part, is favored by the complexity of ascertaining value; by acting early, he may get the land at a particularly favorable price. Together with the opportunity to gain urban plottage value, these factors suggest that fringe land will be sold in many cases before it is in fact ready for development and while it still has an economic use as farm land.

An Analysis of Land Market Behavior of Farmland Owners in Sacramento County

Traditional economic reasoning indicates that the owner of a resource such as land will put it into the use which maximizes its present value. This premise was explored by a team of economists at U. C. - Davis in the early 1970s (Hansen and Schwartz, 1975) in research on the land market behavior of a sample of Sacramento County farmland owners.

The researchers focused on three areas: the North Natomas, the Foothills and the Stonelake/Franklin area. They used a combination of assessment data, in-depth interviews of landowners and a mailed questionnaire to provide indications of land values and information participation in Williamson Act contracts: agreements between the landowner and the local general purpose government which commit the landowner to maintain agricultural use of the land over a ten-year period in return for land valuation at agricultural use for property taxation. (See Appendix B for a discussion of the Williamson Act as a measure to encourage agricultural land retention.)

The researchers' findings are of considerable interest. First, of the three areas studied, the North Natomas has the lowest rate of participation in the Williamson Act: only 10 percent of the owners and 18 percent of the land. Second, the higher the tax savings offered by the Williamson Act, the more likely that the property is enrolled. Of the four types of agricultural use considered, dry pasture land receives the greatest tax reduction under Williamson Act provisions, and is more likely to be enrolled in the program than rice land, irrigated pasture or row crop land.

Third, characteristics of the owners influence whether or not property is enrolled: farmer-owners are more likely to participate than non-farmer-owners, local residents are more likely to participate than nonlocal residents (owners living more than 50 miles away), and corporate owners are much less likely to participate than individual owners. Further analysis found that nearly all contracts are held by owners expecting development to occur more than 20 years hence.

Having assembled this basic behavioral data, researchers then conducted a retrospective analysis of land value changes for 65 agricultural parcels within about five miles of downtown Sacramento, only one of which had been enrolled in a Williamson Act contract. The conclusion of this part of their study was that enrollment in the Williamson Act program would have been a better economic choice for at least 80 percent of the parcels they studied during the period covered by the analysis, 1962 to 1973.

Of course, the passage of Proposition 13 has provided substantial tax relief for all agricultural land, whether or not it is enrolled. The main point of the Hansen and Schwartz research is not so much to advocate greater participation in the Williamson Act as to point out that:

- high development expectations are a cause of low Williamson Act enrollment, and
- landowners are overly optimistic about their ability to achieve an exceptionally favorable sale.

Thus, the premise that landowners will act to maximize the present value of their land was not sustained: owners who would have been better off contracting their land did not do so, apparently because they believed that developability was closer at hand than it turned out to be.

Development of North Natomas Farmland: Is the Time Ripe?

The farmland owners were not the only ones who believed that the Natomas area would be developable some time in the 1970s. Another analysis of development patterns and trends in Sacramento County had been completed earlier by a second researcher (Harris, 1966). This work had a very simple methodology in which the basic determinant of the development sequence was an accessibility index. Using this approach, the researcher predicted that a substantial segment of the Natomas (his work included areas both north and south of the present I-880) would be ready for development.

Taking both of these studies into account, one would conclude that at least part of the Natomas area was "ripe" for development by the close of the 1970s,

whether that "ripeness" is defined in terms of observation of landowner behavior or by a simple model of urban accessibility. But such "ripeness", in both cases, depends specifically upon the assumption that agricultural use designations in the general plan and the zoning ordinance are not permanent. Whether we base our judgment of developability on landowner perceptions or on a mathematical model, in neither case does the analysis attempt to identify or quantify an actual nonagricultural market for the land - which may explain why the landowners' beliefs about the development horizon proved to be excessively optimistic.

Of course, the fact that landowners were overly optimistic about the development time frame 10 and 15 years ago does not necessarily mean they are being overly optimistic now. But rising land prices alone do not prove there is a non-agricultural market for the land; it simply proves that there are high expectations that development will proceed in the short run. Hansen and Schwartz concluded that an increase in Williamson Act enrollment by fringe land owners could only be accomplished by reducing landowners' expectations, and they suggest "the exercise of more effective local planning and zoning" as the best way to reduce premature conversion.

Current Land Market Conditions in the North Natomas

A program of research to determine current land market conditions in the North Natomas was conducted for this study using interviews with individuals (real estate brokers, bank loan officers, credit associations and appraisers) familiar with land sales and price trends in the area, and a review of transaction data in the office of the Sacramento County Assessor. Information was sought on both the incorporated and the unincorporated areas.

Indications that the North Natomas Is Viewed as Future Urban Land

Actors in the land market in the North Natomas report a number of circumstances suggestive of a growing belief that at least part of the area will be opened to urban development in the short run: a substantial decline in

agricultural loan activity, the emergence of land transfer instruments indicating a transitional stage, and reported increases in land values to levels in excess of agricultural use values.

Agricultural loans have declined, at least in part, because high land prices make purchases for agricultural use uneconomic. Appraisers valuing land in the area (ten were interviewed for this study) no longer find the income approach to valuation relevant; both they and the County Assessor use the market approach (comparables) almost exclusively. When land changes hands, transactions often take the form of leaseback agreements or options, suggesting that seller and buyer believe a use change may be imminent.

Observations on Current North Natomas Land Prices and Values

As the theoretical model described earlier in this chapter suggests, it can be difficult to value land when ultimate developability is uncertain. It is this uncertainty that inhibited several of the appraisers interviewed from offering their judgments as to land values north of Interstate 880. One appraiser said that land values in the entire North Natomas are "in limbo" until the city completes its general plan revision. Those interviewed agreed that agricultural zoning was not dissuading nonfarmer investors from buying.

Brokers, appraisers and bank loan officers who would comment reported land sales at prices generally in excess of what they believe to be agricultural use value. Rice land, which a grower was said to be able to afford at up to about $3,500 an acre, is selling for as much as $4,500, according to one of the appraisers. Another puts the agricultural value of most North Natomas land at $2,500 while sales are taking place in the unincorporated area at $3,200 to $4,000. A bank representative reports that land without much prospect for development is selling at $2,500 to $3,000 per acre, while land perceived to have development potential is going for $10,000 to $12,000 per acre and more.

In general, those interviewed set use values of agricultural land at about $2,500 to $3,500 while recent sales were typically said to be equivalent to $4,500 per acre.

Empirical Data on North Natomas Land Prices

Information supplied by appriasers, brokers and bankers was supplemented by a review of land sales records in the office of the County Assessor. Table 26 (p. 62) presents data on transactions in the North Natomas reported in the Assessor's Deed Log between March 1980 and September 1981.

In all, about 30 North Natomas transactions are reported, affecting 37 parcels in the incorporated area and 23 in the unincorporated area. In the incorporated area, all but one of the transactions involved multiple parcels, from which one could infer that land assembly is taking place in anticipation of a use change. Often, the seller was specifically listed "farmer"; buyers were often identified by the brokers interviewed as linked with development interests.

Sales prices reported in the Assessor's Records neither represent the full volume of property transfers nor "pure" land prices. In some sales, particularly of small parcels, prices reflect improvements as well as land. Sales records may not include contracts of sale. The dollar value of transactions may be affected by other considerations than land value, such as the settlement of a partnership interest or a land trade. Finally, sales prices reported may err, intentionally or unintentionally. For these reasons, the reader is advised to view the data reported in Table 26 with some skepticism.

Nothwithstanding the reliability problems just mentioned, the sales data presented in Table 26 provide some important insights on values of agricultural land in the North Natomas. Table 27 (p. 63) summarizes transaction data on all agriculturally-zoned parcels exceeding ten acres in size (in fact, none of the smaller parcels was larger than three acres). Table 27 thus permits a concentrated analysis of those transactions which affect agricultural land. Several important conclusions can be drawn from the data.

Table 26

Land Sales in the North Natomas, March 1980 through September 1981

Date: 1981	Seller	Buyer	Land Status[1]		Acreage	Value ($1,000)	Value per Acre	Parcel(s)
Sept. 9	[illegible]	[illegible]	U	AG-40	1.00	165	165,000	125-200-0500
Aug. 12	[illegible]	Kelly	U	AG-40	1.00	121	121,000	201-150-2900
June 6	[illegible]	[illegible]	U	AG-80	142.00 (3 parcels)	326	2,224	201-120-0100, -4300, -4500
May 5	[illegible]	S/B Interland	I	A	37.33 (3 parcels)	2,280	60,719	225-160-2000, -170-1800, -170-1900
May 4	[illegible]	[illegible] et al.	I	A	30.00	38	1,267	225-160-1100
Mar. 25	[illegible]	S/B Interland	I	A	146.28 (2 parcels)	310	2,422	225-160-0100, -0700
same	Cal [illegible]	[illegible]	I	A	447.50 (10 parcels)	1,958	4,380	225-080-0200, -0300, -0400, -0500, -0700, -0800, -1500, -1600, -1700, -1800
Feb. 17	[illegible]	[illegible]	U	AG	141.38	138	1,199	201-110-1700
Jan. 26	[illegible]	same	U	AG-40	27.22 (2 parcels)	364	13,225	201-190-1300, -2000
Jan. 6	Weaver Tractor	Buckley	U	C-2	25.00	904	36,160	225-120-4100
1980								
Dec. 3	[illegible]	Jefferson Bldg. Co.	I	A	118.00 (2 parcels)	419	3,509	225-040-26, -27
Nov. 17	Weaver Co.	Community Psychiatric	U	A-2	10.78[4]	233	21,776	225-120-4700
Nov. 12	[illegible] Land	Frith	U	AG-10	1.00	90	30,000	225-120-4900
Nov. 6	[illegible]	[illegible]	U	AG-40	1.00	71	71,000	201-260-3800
Oct. 29	[illegible]	[illegible]	U	RE-2F	1.00	112	112,000	225-090-2700
Oct. 10	[illegible] Farms	[illegible]	U	AG-20	308.00	212	1,012	201-030-1500
Aug. 26	Collins	[illegible]	U	RE-2	1.12	118	102,608	201-150-1400
Aug. 13	[illegible]	[illegible]	U	AG-40	1.00	265	265,000	201-260-3900
July 23	Oliver	[illegible]	U	AG-20	19.00	80	4,000	225-170-2100
July 16	[illegible]	S/B [illegible]	U	AG-80	132.00[3]	666	6,577	225-060-1200
July 2	[illegible]	[illegible]	U	AG-80	152.00	1,529	10,059	same
June 26	McDonalds [illegible]	Willow Creek Assoc.	U	AG-1	1.43	49	34,507	225-120-1700
June 12	Miller, Inc.	[illegible]	U	AG-40	1.00	48	48,000	201-150-1200
May 30	McDonalds [illegible]	Willow Creek Assoc.	U	AG-20	25.00	904	36,160	225-120-1700
same	same	same	U	A-2	37.20	690	18,549	225-120-3600
May 26	Clark	Clark	U	A-2F	1.00	28	18,000	201-170-1700
May 13	[illegible]	Greenbriar Farms	U	AG-80	15.00[3]	102	1,278	201-300-5900
May 12	[illegible]	[illegible]	U	AG-80	35.80	123	3,789	same
same	[illegible]	Greenbriar Farms	U	AG-10	10.44	30	2,873	201-300-4200
May 9	Garms Farms	MCR Properties	I	A	470.00[4] (2 parcels)	3,706	7,885	201-300-7100, -7200
same	MCR Properties and Cal [illegible] Farms	Garms Farms	I	A	700.00 (17 parcels)	1,594	2,277	201-300-3600, -5400, -4500, -4900, -110-0100, -0200, -0300, -0400, -0500, -0600, -0800, -2000, -2100, 225-040-0900, -1000, -1900, -2100
May 8	MCR Properties	Greenbriar Farms	I	A	470.00[4] (2 parcels)	3,706	7,885	201-300-7100, -7200
Mar. 7	Weaver	Buckley	U	AG-10	3.00	70	23,333	225-120-4800
TOTALS								
Unincorporated Area					1,289.71 (26 parcels in 23 transactions)	7,562	6,339	
Incorporated Area					1,942.55 (37 parcels in 7 transactions)	10,305	5,305	
GRAND TOTAL					3,032.26 (63 parcels in 30 transactions)	17,867	5,892	

[1] I = Incorporated (lying within City of Sacramento boundaries); U = unincorporated (lying outside City of Sacramento boundaries). Other designations indicate current zoning. All parcels within the city are zoned A (agriculture). County zoning districts are as follows:

A-2	Agriculture	(1 unit/2 acres)
AG-10	Exclusive Agriculture	(1 unit/10 acres)
AG-20	Permanent Agriculture	(1 unit/20 acres)
AG-40	Permanent Agriculture	(1 unit/40 acres)
AG-80	Permanent Agriculture	(1 unit/80 acres)
RE-2	Rural Estates	(1 unit/2 acres)
C-2	General Commercial	
(F)	Flood Combining Zone	

[2] Two different sales prices were reported for this transaction. Only the higher is shown.

[3] Each of these transactions is the second sale of a given parcel within a brief time period, and in each case the price reported at the second sale was lower, suggesting that the sale was part of a partnership settlement, a land trade or some other action. These second sales have not been included in the totals.

[4] Assessor's records reverse the order of these two sales. The property actually moved from [illegible] by Garms Farms to MCR to Greenbriar (the current owner). Only one of these transactions is included in the total.

Source: Tabulated by [illegible] & Associates from Sacramento County Assessor's Deed Log. Assistance provided by Michael [illegible], Real Property Appraiser, December 11, 1981, and [illegible], Real Property Appraiser, January 12, 1982.

Table 27

Summary of Sales Transactions
Involving North Natomas Agricultural Parcels*,
March 1980 Through September 1981

	Incorporated Portion	Unincorporated Portion	North Natomas Total
Transactions	7	11	18
Parcels	37	14	51
Acres	1,942.55	1,048.16	2,990.71
Total Value	10,305,000	5,319,000	15,624,000
Value Per Acre	5,305	5,075	5,224

* All parcels exceeding three acres zoned for agricultural use. (None of the transactions included involved parcels smaller than ten acres.)

Source: Table 26.

First, when obviously nonagricultural parcels are omitted from the analysis, values in the incorporated area exceed values in the unincorporated area, a differential one normally encounters at the edge of urban areas.

Second, average values exceed agricultural use values, but the difference is not very great. A price of $5,000 an acre may be affordable to some agricultural buyers depending on their existing land ownership situation and their management ability.

Finally, average prices are well below prices which have been rumored for land in the area. For example, a newspaper article (Sacramento *Bee*, November 29, 1981) states that "the going price of land within the boundaries of the potential industrial park is reported to be as high as $43,000 an acre in at least one transaction." While that report may be accurate, it is not at all reflective of average prices at which land has changed hands in the last two years.

In conclusion, sales data in the Assessor's Records suggest that, while some land prices in the North Natomas have risen well above agricultural values, these high prices seem to be associated with small parcels. Many recent transactions have occurred at reported prices not inconsistent with farmland use. Widespread reports of higher prices may stem from a small number of atypical transactions, from the inaccurate reporting of actual purchase prices, or from efforts of those with an interest in the land market to encourage further price increases by exaggerating actual sales prices.

Land Price Increases as Part of a Fringe Land Conversion Scenario

The North Natomas represents a specific case of a not uncommon scenario in which urban conversion of agricultural land, if it should take place, will have been a self-fulfilling prophecy. A number of coincidental factors - investors' hype, farmers' optimism about prompt use change, even economists' scholarly research - create a climate of expectation in which land prices rise, irrespective of the stated land use policies of local government and whether or not a nonagricultural market for the land actually exists.

Often, by the time a proposal for an actual use change reaches the local decisionmaking agency, land prices have already reached a level that makes continued exclusive agricultural use regulations look foolish - which, of course, is the perception at least some of the landowners hope to create. Nonfarmer owners, whose farm management skill may not be up to the level of more experienced farm operators, may argue that they cannot profitably farm their land. If the land prices they paid exceeded agricultural use value, which they may well have if conversion was the objective, their inability to make what they consider an adequate return on their total land investment is understandable.

There is ample evidence that this is the scenario being played out in the North Natomas. The City of Sacramento, through its General Plan Update, will now play its part.

DECISIONMAKERS' DILEMMA

The Context of Decisionmaking for the North Natomas

Those charged with the responsibility of specifying future planning and zoning regulations for the North Natomas face an awesome task. This report is one of several which provides information bearing on the city's decision. Other documents address fiscal issues, nonagricultural employment issues, and planning alternatives within the framework of the General Plan Update for the entire City of Sacramento.

These various background documents are voluminous and occasionally technical, but that is only part of the challenge. The other part relates to the fact that land use regulations are rarely wholly impersonal. Particularly when a change in use designation can have an important impact on the financial position of an owner, or on his or her long term ability to continue the present use of the land, the owner can be expected actively to participate in the evolution of the general plan, and the City Council can be expected to seek and give attention to the testimony of affected constituents on their desires and objectives for both their land and the city as a whole.

This report has attempted to present information on agricultural land use and activity in the North Natomas area in an objective manner in order to assist decisionmaking bodies in understanding the character of the area and the concerns of some of its landowners at the present time. The report also discusses some of the implications of urban conversion and suggests that there is presently considerable uncertainty about the future which the current city policy review may help to alleviate.

In this concluding section of the report, a contribution to the formulation of city policy is offered in two parts: (1) a review of some of the more important agriculture-related concerns that must be taken into consideration in any decision to alter the permitted land uses in the incorporated North Natomas, and (2) a sketch outline of some of the implications of one possible option the city might choose.

Important Agriculture-related Concerns

The principal conclusions drawn from the research conducted on North Natomas agriculture for this report, in the judgment of the author, are the following:

- Land in the North Natomas is generally good quality agricultural land. Much of it would be considered prime farmland. The combination of good soils, climatic characteristics and a dependable water supply make the North Natomas particularly well suited to continued agricultural production.

- There is little land available possessing the qualities of North Natomas land that is not already in production in the three-county area.

- Other land which could be brought into production to substitute for North Natomas land has associated with it a variety of costs: capital costs for development of cropland, the foregoing of the use to which the land is currently applied, and higher production costs stemming from inferior production conditions and lower yields.

- A change to nonagricultural use in the North Natomas implies the loss of agricultural and related employment and income in the region.

- Current land price trends suggest that a transition to nonagricultural use may be anticipated. Expectations of land sellers and buyers are premised on a change in current zoning designations.

- Notwithstanding such expectations, however, significant acreages in the North Natomas have been bought and sold in the last 18 months at reported prices not inconsistent with continued agricultural use.

- Available information on direct production costs and gross agricultural revenues indicates that North Natomas farmland generates a gross profit before a land charge.

- Available information suggests that North Natomas farmland generates a net profit after a land charge if one assumes a return of ten percent on the land's agricultural value and a zero return on the portion of land prices attributable to the anticipation of a use change.

Partial Urbanization: Impacts and Agricultural Land Planning Implications

One of the options available to the City of Sacramento is to permit urban development of a portion of the incorporated North Natomas to take place over a specified time frame. For example, the city could authorize urban use for that portion of the North Natomas lying south of Del Paso Road. What would be the impacts and implications of such a policy as they relate to North Natomas agriculture?

The economic impacts of such a policy could be estimated based on information presented in Chapter II of this report. In general, they would include lost agricultural revenue, a reduction in agricultural and agriculture-related employment, and the erosion of the kind of economic activity needed to maintain linked production in food processing and other industries. There will also be a decline in revenues to public agencies resulting from the reduction in agriculture-related activities. Of course, all these declines may be more than offset, at least on a regional balance sheet, by the establishment of other kinds of jobs and incomes on the land made available for development. Without a sound economic base study and regional economic forecast, it may not be possible to determine definitively whether the elimination of part of the area's agricultural sector will result in a net economic loss. In the past, under general national conditions of economic growth, typically such a change would not have resulted in a net loss.

Also important in a comprehensive consideration of this option are its implications for agricultural uses which will continue to exist in the balance of the North Natomas area, and in adjoining areas. A number of planning issues and questions should be kept in mind.

The Impermanence Syndrome. A decision to develop part of the North Natomas will be considered by local landowners, and by the land investment community, as indicative of likely further changes in the urban/agricultural boundary in the future. Rising land prices and deteriorating soils maintenance are among the likely results of what has sometimes been called an "impermanence syndrome" in which the failure to establish a firm and fixed agricultural use area itself contributes to conditions leading to further conversion in the future.

The Need for a Clear Urban/Agricultural Boundary. There is no strong physical barrier north of I-880 which could function as a clear delimiter of urban vs. agricultural land. Such a separator can be important both for psychological and practical reasons. Some would argue that to permit major urban development to cross I-880 essentially opens the entire northwest portion of the county to urban development, with rippling effects on land values and land maintenance extending to the county line and beyond.

The Problem of Multiple Jurisdictions. The city's power to control development is limited to the incorporated area. City policy on the development (or nondevelopment) of the incorporated area can be diminished in effectiveness if county policy operates in a contrary direction. This is particularly true if the city opts for maintenance of agricultural use, while the county permits development.

Soil Quality Is Not a Workable Basis for Land Use Planning in the Natomas. Permitting development on soils of inferior quality while maintaining exclusive agricultural use on the better soils generally does not work: urban and agricultural uses pose too many compatibility problems. In any event, only a very small proportion of the land in the incorporated portion of the

North Natomas could be argued to be "inferior", and even those lands are not clearly inferior to other land in Sacramento County currently in agricultural production.

Are There Alternative Sites for Development? Experts in agriculture agree that the North Natomas area is particularly well suited to agriculture. It may be argued that those who propose an alternative use should bear the burden of proof that the region lacks alternative locations for development.

Balancing Gains and Losses Resulting from a Use Change. Since the benefits of agriculture - both economic benefits and less quantifiable benefits arising from its open space character - are known and recognized, the city is aware that these benefits will be irreversibly lost if urban development takes place. Can this loss be offset, and how dependable are the benefits attributed to the new land use?

The agricultural and planning concerns discussed in this chapter are among the important considerations which should form the framework for Sacramento's policymaking on the North Natomas. This report has attempted to focus on part of the factual background of the policy review - it does not attempt to forecast the future. As has been well stated elsewhere (NALS, 1981), "the future of agricultural land is not to be gleaned simply from the study of objective fact. Rather, the future is one people today are creating, and largely through the effects of their public policies." A major purpose of this report, like the National Agricultural Lands Study, is "to aid in a deliberate choosing of future directions."

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January 11, 1982

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Soil Conservation Service
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Ray Borton
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(Yuba City)
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Gene Chesney
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Richard Fraschetti
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Jim Hobson
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Justice Hubbard
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APPENDIX A

DEFINING FARMLAND RESOURCES

Farmland, or agricultural land, is not limited to land in active cultivation of crops, but includes as well land used for grazing, forest land, and idle land suitable for those uses. Agricultural resources are generally more narrowly defined in a manner reflecting the planning or policy purpose involved. Several of the major definitional systems in current use are described below as background to the task of defining agricultural land resources in the North Natomas area.

THE LAND CAPABILITY CLASSIFICATION SYSTEM

This is the system used by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) in its soils classification and mapping projects, which are conducted generally on a county basis.

"It is an interpretative classification system for agricultural purposes which uses soil and climatic data to place delineated soil areas into groups of approximately similar management options or problems" (Reganold and Singer, 1978). The broadest classification is the capability class, expressed as Roman numerals I through VIII, with Class I soil being capable of production of common cultivated plants virtually without limitation; Class VIII, at the other end of the capability spectrum, includes sandy beaches, rocky outcrops and other nearly barren lands. Each of these major classes is further categorized according to a variety of characteristics which reflect production conditions and risks of environmental damage. The application of the classification system is primarily to group lands according to recommended conservation practices.

THE LIM APPROACH

The USDA has set forth definitions of various categories of agricultural resources in its land inventory and monitoring (LIM) memorandum (USDA, 1975).

The intention of the LIM system was to make possible an inventory of the nation's best farmland, using a consistant set of definitions. For prime farmland, the definition relates primarily to soil quality, growing season and moisture conditions, and is expressed in technical and quantitative terms, a lay translation of which follows:

> In general prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

In addition to prime farmland, the LIM memorandum also defines unique farmland, additional farmland of statewide importance, and additional farmland of local importance. Each of these types of resources rank among the important types of agricultural lands, which is the LIM focus, in contrast to the land capability classification system, which address all non-urban lands.

THE STORIE INDEX

Both the USDA systems described above are interpretative: the quality classification is based upon an interpretation of the joint effects of a variety of resource and environmental conditions. The Storie index differs from these because it establishes numerical scores for performance under four ratings (soil profile, surface texture, slope, and other characteristics rated collectively); the soils are rated on each scale from 0 to 100 and the scores multiplied together, the product being called the Storie Index Rating.

THE WILLIAMSON ACT DEFINITION

Crop production in California is not limited to areas of superior soils. While certainly soils classified as "prime" under the LIM definition, as

Class I or Class II under the SCS classification system, or with a Storie Index Rating exceeding 50 command the greatest share of California's crop production, there are many lands of lesser soils which are cultivated for important crop production. This fact was recognized when the California legislature identified lands that would potentially be eligible for participation in the state's use value taxation system for agriculture. In particular, the state had to address the fact that the preceding definitions of superior soils do not encompass all of California's superior production conditions. For that reason, the definition of prime agricultural lands under the Williamson Act is much broader, including all of the following:

- USDA Class I or Class II
- Storie Index Rating of 80 to 100
- land that returned an annual gross value of not less than $200 per acre for three of the last five years
- livestock-supporting land with a carrying capacity of at least one animal unit per acre
- land planted with fruit or nut trees, vines, bushes or crops that have a nonbearing period of less than five years and that will normally return $200 per acre per year during the commercial bearing period

Such a definition reflects the state's policy to extend favorable tax treatment to our most productive agricultural lands even if those lands, by technical definitions of soil quality, might not be considered superior.

A DEFINITION OF PRODUCTIVE AGRICULTURAL LAND IN THE NORTH NATOMAS

In keeping with the State of California's approach, it is evident that a broader definition than one limited to soils type would be relevant for the North Natomas area, where rice may generate an income stream on Class III soils which exceeds the income generated by rotational crops (tomatoes and corn, for example; see discussion pp. 11-14) grown on Class II soils. (The fact that rice need not be grown in rotation with other crops contributes to its profitability.)

From a resource point of view, it may still be useful to be aware of the extent of prime soils in the North Natomas, and preliminary reports of the current SCS soil survey indicated that the incorporated portion of the North Natomas is about 80 percent prime soils (where "prime" is defined as Class I and Class II).

From the point of view of agricultural impacts on the City and County of Sacramento, the soil types are less important than the overall revenue from agriculture. For that reason, the focus of the analysis of the economic impacts of North Natomas agriculture presented in Chapter II of this report is on *productive agricultural land*, which is defined as land presently or recently in commercial agricultural use.

APPENDIX B

FARMLAND RETENTION TECHNIQUES

Recent losses of farmland to nonagricultural development in Sacramento and its county, state and nation are discussed in Chapter III of this report. The magnitude of the loss has helped draw attention to a variety of programs intended to reduce the rate at which farmland is irreversibly converted to nonagricultural use.

STRENGTHENING THE FARMLAND OWNER'S ABILITY TO WITHSTAND CONVERSION PRESSURES

Agricultural land, like any other land resource, is part of a broader land market within which the independent actions of buyers and sellers, investors and developers, change the patterns of overall land use over time. Agricultural land commands a price for its agricultural use value, as described in Appendix F; it may command a different price, which can be more, but may be less, for alternative uses. If the agricultural use value of land always exceeded its value in alternative uses, there would be no pressure for conversion. Some agricultural assistance programs arise from this consideration: if we make farming more profitable or reduce the risks the farmer faces, we will increase the farmland owner's ability to resist conversion pressures. The following are programs which tend to strengthen the farmer's ability to resist conversion.

Differential Assessment

Under such programs, farmland is generally taxed at its value in farm use. Such programs reduce a farmer's operating costs if his property taxes on land appraised at highest and best use would be higher. As of 1980, all but two states had implemented such a program in some form, California's having been established in 1965 by the Williamson Act.

Other Tax Relief Programs

The National Agricultural Lands Study (NALS, *Guidebook*, 1980) inventoried a variety of other tax relief programs, which include property tax credit against state income taxes (two states) and death tax benefits. The latter program was assisted by the passage of the Tax Reform Act of 1976 which enabled at least 70% of farm estates to be exempted from estate tax liability. About half the states, including California, have taken steps to make some form of preferential valuation (such as agricultural use valuation of farmland inherited by family members) available for farm estates.

Subsidizing Input Costs

Agricultural production may depend upon inputs, such as water and energy, for which farmers may be charged lower unit prices than other consumers pay or would pay. Such subsidies, like use value taxation, make farming more profitable than it would otherwise be, by reducing the farmer's operating costs.

Off-farm Research and Development

Research into agricultural production technology is supported by a variety of industry and public funds. Product development and market research functions which in the typical industry are direct costs to the business enterprise are rarely paid for directly by farmers. These off-farm investments in agriculture can have important payoffs to individual farmers in soil management, pest control, species improvements, and other aspects of farm operation.

Agricultural Districting

The districting approach rests on the premise that if farmers will voluntarily establish areas within which farming will be the only activity, and if such areas are protected from various influences that tend to make farming un-

desirable or unprofitable, farmers will be more likely to keep their land in agriculture. NALS (*Guidebook*, 1980) inventoried six state programs establishing agricultural districts (including California under the Williamson Act) but both NALS and independent critics (Farmland Institute, 1981) have found this approach not very successful in stemming agricultural land conversion. In California, districting requirements are very lenient: districts need not be very large and need not be composed, in any given county, of contiguous lands. Furthermore, until recently, Williamson Act contracts could be cancelled with relative ease prior to their 10-year expiration period. NALS concluded that districting is not an effective anti-conversion measure, but that it does provide rural farmers "with an enhanced sense of security and a modest protection against special assessments and eminent domain".

Right-to-Farm Legislation

One of the problems faced by farmers with land at the edge of urban areas is that they are subject to a variety of actions by their neighbors which can have the effect of restricting the range of normal farm management practices. NALS found that 11 states have enacted laws protecting against local government regulations that "unreasonably restrict or regulate farming structures or practices unless they are needed to protect the public health or safety". In two states, the same protection is extended against state legislation. In 10 states, laws have been enacted protecting farm owners against private nuisance lawsuits. A total of 16 states have enacted one or both of these protective approaches; California has not.

STRENGTHENING GOVERNMENT'S ABILITY TO MAINTAIN LAND IN AGRICULTURAL USE

Exclusive Agricultural Zoning

Zoning land for agricultural use is the most widespread measure to protect farmland resources, with about 270 local jurisdictions using this approach across the nation (NALS, *Guidebook*, 1980). The strongest of these measures restrict agricultural zones to exclusive agricultural use.

Ten jurisdictions with exclusive agricultural zoning were studied in depth by the National Agricultural Lands Study, including two California counties, Stanislaus and Tulare. NALS concluded not only that exclusive agricultural use zoning was working, but that where it has been adopted political support for the technique has continued to grow and complementary measures to protect farmland have also been adopted.

Basically, a major gain from this approach is that the communities begin to look at agriculture as "a long-term, permanent, land use". NALS found evidence of changes in the pattern of land speculation suggesting that actors in the land market give credence to exclusive agricultural zoning. Local staff and officials also believe that development activity in agricultural land has been greatly reduced, in part because restrictions on non-farm uses have been strengthened and because rezonings, particularly on good agricultural land, are not being permitted. In the absence of strong state-mandated agricultural land protection programs, exclusive agricultural zoning at the local government level appears to be the most effective agricultural land conservation measure available.

State-Mandated Agricultural Land Use Controls

Several states have mandated agricultural land preservation programs, either working through local government or directly administered by the state (Hawaii has state zoning). Oregon and the Canadian province of British Columbia both have comprehensive and well-integrated programs which have withstood legal challenge. Local agency policies, plans and zoning ordinances must be brought into consistency with state goals and policies for agricultural land preservation.

At the state level, support for these programs is high, and state programs are not as vulnerable to day-to-day pressures as local programs can be. NALS concluded that a strong state policy is really the key to effective agricultural land preservation: without a comprehensive state policy statement regarding the public purposes being served by agricultural land preservation,

it can be difficult to defend local agricultural land regulations in a legal context. California, except in the coastal areas, lacks such a basis for local agricultural land protection measures. A state requirement that local governments prepare agricultural elements of their general plans would help, as such elements can establish a firm policy basis for local actions. Any California community with extensive agricultural land use would be expected to address agricultural issues in the mandatory elements of its local general plan. A recent publication by the California Office of Planning and Research (California, State of, November 1981) provides valuable assistance.

Growth Limitations

Stringent limitations on urban zoning, quantitative building permit limitations and quantitative population limits have been viewed as agricultural land protection measures in some communities. Such measures ignore extrajurisdictional effects: where the land market is strong, development pressures may simply be displaced to more lenient jurisdictions, possibly resulting in greater agricultural land conversion at the displaced location than would have been experienced in the regulating community. Growth limits, unless a part of a multi-jurisdictional agricultural preservation plan, are likely to be counter-productive where growth pressures are strong, and are unlikely to exist elsewhere.

Growth Management and Public Facility Extension Policies

An integrated local development strategy which combines agricultural preservation with the identification of development areas can be an effective means of limiting the impacts of urban growth on farmland. Public facility extension policies can be a key element in growth management: sewer and water extensions can be limited to areas targeted for development. For example, the City of Modesto proposed, in an agreement with EPA, to extend sewer trunks toward the northeast area of that city in a long-term strategy to guide growth

away from prime farmlands and toward lands of lower soil quality (U. S. Environmental Protection Agency, 1979). Such an approach is particularly effective wherever development depends on public infrastructure. However, if low-density development can proceed on private water and wastewater systems, the impact of infrastructure extension policies is much reduced.

Purchase of Interest in Land

The purchase of development rights may be proposed complementary to, or in lieu of, agricultural zoning, particularly in jurisdictions in which the the political feasibility of agricultural land protection through zoning is doubtful. Compensation to the landowner, the use of whose land is radically restricted by agricultural zoning, may be an indispensable element of a zoning program in some jurisdictions.

NALS surveyed four state purchase-of-development rights (PDR) programs (Maryland, Massachusetts, Connecticut and New Hampshire) and six local government programs, all on the East Coast except King County, Washington. A PDR program is very effective in the sense that it keeps farmland from being developed virtually indefinitely. However, it has a number of weaknesses, including the fact that it is expensive for the local agency and that it is voluntary on the part of landowners, meaning that there is no certainty that land affected will be clustered in an efficient pattern or that a critical mass of farmland will be protected.

Facilitating the Transfer or Retirement of Development Rights

Rather than purchasing the development rights pertaining to farmland, local governments can establish systems for transferring such rights to private parties either by sale or gift. Under the former approach, farmland owners can sell their development rights to other property owners in the same jurisdiction, who by virtue of that purchase are empowered to develop their own lands at higher density than would otherwise have been permitted.

Alternatively, development rights may be deeded to a conservation organization by gift or acquired by a private land trust. Both of these approaches have a number of difficulties in implementation, which may explain why NALS found only four TDR transactions involving a total of 184 acres as of 1980, and did not report any gifts, bequests or other transfers involving donations of development rights to public bodies or private trusts.

GENERAL CONCLUSIONS

The nationwide review of farmland retention programs completed by the National Agricultural Lands Study found that the most common local program is zoning, but that there have been few widely-imitated approaches and each agency has sought its own direction. This conclusion seems to reflect California experience as well: the State Office of Planning and Research has found that California counties are using varying definitions of agricultural land, and that there are no clear patterns in performance among counties which consistently use, or fail to use, varying preservation techniques (California, State of, March 1981).

In reviewing the record to data, NALS made a number of recommendations concerning the successful implementation of agricultural land retention programs. Among these:

- State governments should assume an active leadership role in protecting agricultural land.
- Protecting agricultural land is best achieved in tandem with measures to direct permitted development as part of a comprehensive growth management system.
- Agricultural land protection programs should be established before development patterns foreclose options.
- Agricultural land protection programs should support the economic viability of agriculture in an area.
- Agricultural land protection programs should be designed so they are legally defensible.

APPENDIX C

PERSPECTIVE ON THE AGRICULTURAL LAND SUPPLY

FORWARD

In 1979, the U. S. Environmental Protection Agency issued its Final Environmental Impact Report on the Modesto Wastewater Facilities Plan. The rationale for preparing an EIS on Modesto's plan, was, in part, the fact that the growth which would be accommodated by the proposed wastewater facilities would result in the conversion of a significant amount of prime agricultural land. EPA is required by Agency regulations implementing the National Environmental Policy Act of 1969 to prepare an EIS whenever its actions (such as project funding) may adversely affect prime farmland.

EPA contracted with the environmental firm of Jones & Stokes Associates to prepare the EIS on the Modesto plan. Working with Jones & Stokes on the EIS were Gruen Gruen + Associates (economics and land use) and H. Esmaili & Associates (agronomy and soils science). Chapter 5 of the Final EIS addressed issues of urbanization of prime farmland: overall supply and conversion rates, conversion impacts, how conversion can be mitigated, the specific mitigation program of Modesto, and the effectiveness of that program. Work on this chapter was directed by Roberta M. Mundie, then Gruen Gruen + Associates' vice president and senior planner.

This appendix is an excerpt from the Modesto EIS. The sections included provide national and California perspectives on the supply of prime farmland. Prime farmland was the focus of that report because EPA regulations specify a concern for that particular resource. Since much of the nation's cropland in current production is on soils classified as prime, the terms "prime farmland" and "cropland" are often legitimately interchangeable.

Although the work for EPA was substantially completed in 1978, the material presented here remains current. A re-examination of the national agricultural land supply (NALS, 1981) has not resulted in any change in the conversion estimates set forth in the Modesto work. There has been no new research at the state level since the work reported on here was completed.

Chapter 5

URBANIZATION OF PRIME FARMLAND

Introduction

A major issue addressed by this EIS is the projected conversion of prime agricultural land to urban uses which will be made possible by the proposed expansion of the Modesto wastewater facilities. The EIS is required to consider this issue pursuant to the directive of the U. S. Council on Environmental Quality (CEQ) stating that "highly productive farmlands" are among those "important historic cultural and natural aspects of our national heritage" which it is federal policy to preserve:

> "Efforts should be made to assure that such farmlands are not irreversibly converted to other uses unless other national interests override the importance of preservation or otherwise outweigh the environmental benefits derived from their protection" (CEQ, 1976).

Regulations of the U. S. Environmental Protection Agency (EPA, 1975) implementing the National Environmental Policy Act of 1969 require preparation of an EIS when implementation of a facilities plan may result in changes that would "adversely affect significant amounts of prime agricultural land or agricultural operations on this land".

The implementation of the Modesto wastewater facilities plan will allow conversion of prime agricultural lands in Modesto and the surrounding area to urban uses. This chapter addresses the significance of that impact by evaluating the importance of prime farmlands from the national, state and local perspectives. To this end, an overview is presented of the amount and character of prime farmland in the United States, in California and in Stanislaus County. Variations in the level of crop acreage and crop yield are discussed briefly and data are presented on the conversion of farmland to nonagricultural uses.

The chapter concludes with an estimate of the projected conversion to urban use of prime farmland in and around Modesto. It then presents an inventory of agricultural land retention measures and a discussion of their application both in theory and in practice. Finally, the measures Modesto has adopted or plans to adopt to mitigate the conversion of prime agricultural land associated with the wastewater facilities expansion project are presented.

Perspective on the Significance of Prime Farmland

Prime Farmland in the United States

The Character of the Prime Farmland Resource. Prime farmland is land suitable for farming or silviculture, possessing attributes established by the Soil Conservation Service (SCS) of the United States Department of Agriculture (USDA): "Soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods" (Lee, 1978).

Prime farmland - or, more technically, prime agricultural land - may be found in rural or in urban settings; it may be used for crops, for pasture or for other agricultural purposes; it may not even be farmed at a given point in time but may instead be in forest use or encumbered by buildings, roads or water impoundments. Basically, it includes all those lands - whatever their current uses - which have soil, climate and water availability characteristics that permit the production of "relatively more food with less erosion and with lower demand for fertilizer, energy and other resources" than nonprime land (CEQ, 1977).

In this EIS, the SCS definition presented above is the applicable definition wherever the term "prime farmland" and "prime agricultural land" are used except where data from sources using different definitions are presented; in those cases, definitional differences are identified.

It should be noted that prime farmland is not the same as farmland, because some farmland is not prime; neither is it the same as rural land, because not all rural land meets the criteria of prime agricultural land (in fact, very little does). The term cropland includes land devoted to the cultivation of field crops, row crops, orchards and vineyards. While not all cropland is prime farmland, much of it is, because crop production depends much more on soil, climate and water availability conditions than does the production of other kinds of agricultural products (such as livestock and poultry). For this reason, a reduction in the amount of cropland is sometimes interpreted as indicating a decline in the amount of prime farmland available for production.

Estimates of the Amount of Prime Farmland. In 1975 the SCS inventoried 384 million acres of prime farmland in the U. S. Of this total, 250 million acres were in cropland, 77 million acres were in pasture and range, 43 million acres

were in forest land, and 14 million acres were in miscellaneous other uses (Dideriksen, 1977). The 1975 inventory updates an earlier (1967) inventory of SCS, which had addressed the question of how much potential cropland existed in the U. S. - land not in crop production, but with high or medium potential for crop cultivation. The 1967 inventory counted 266 million acres of potential cropland, but the 1974 inventory reduced this estimate to 111 million acres, of which only 15 million acres can readily be brought into cultivation. Constraints that preclude bringing the remaining 96 million acres of high/medium potential cropland into cultivation include dense forest cover, seasonal high water tables and high erosion factors (Dideriksen, 1977). It should be noted that the potential cropland figures encompass both prime and nonprime lands which can be converted to cropland. The prime land component of these figures is already accounted for in the total national supply of 384 million acres of prime farmland.

The current national supply of prime farmland in crop production is therefore about 250 million acres; another 15 million acres of prime agricultural land could be brought into immediate crop production without constraints and another 9 million with minimal constraints. The remaining 87 million acres of prime and nonprime land with a high or medium potential for conversion to cropland represents a longer run reserve of cropland resources.

Trends in Agricultural Land Conversion. National land use patterns have remained fairly stable in the decades since 1910, as Table 5-1 shows. As in 1950, cropland in 1974 still comprised approximately 1/5 of the total land use in the country.

Rural Land Use Changes, 1967 to 1975. Land use changes between 1967 and 1975 are presented in Figure 5-1. Total cropland and total pasture and rangeland both declined; forest land increased. The small circle at the lower left of Figure 5-1 represents land which had been in rural use in 1967, but which by 1975 had either been inundated (for reservoirs) or converted to urban use. A total of 24 million acres had passed out of the rural land supply into urban or water use in the 8-year period.

Cropland Acreage Change, 1967 to 1975. Approximately 78 million out of 431 million acres of cropland (defined in the 1975 survey as land in tillage rotation, orchards, and land formerly in such uses) were converted to noncropland uses during the 1967-75 period. Most of the converted cropland acreage was put to less intensive agricultural use

Table 5-1

LAND UTILIZATION, UNITED STATES, SELECTED YEARS 1910-1974

Major Land Uses (millions of acres)	1910	1920	1930	1940	1950	1959	1969	1974[1]
Cropland Used for Crops[2]	330	368	382	368	377	359	333	363
Idle Cropland	23	34	31	31	32	33	51	20
Cropland Used Only for Pasture	84	78	67	68	69	66	88	84
Grassland Pasture[3]	693	652	652	650	631	633	604	598
Forest Land[4]	600	602	601	608	601	728	723	718
Special Uses[5]	NT	NT	NT	NT	NT	147	174	184
Other Land	174	170	171	179	194	305	291	297
Total Land Area[6]	1,904	1,904	1,904	1,904	1,904	2,271	2,264	2,264

NT = not tabulated.

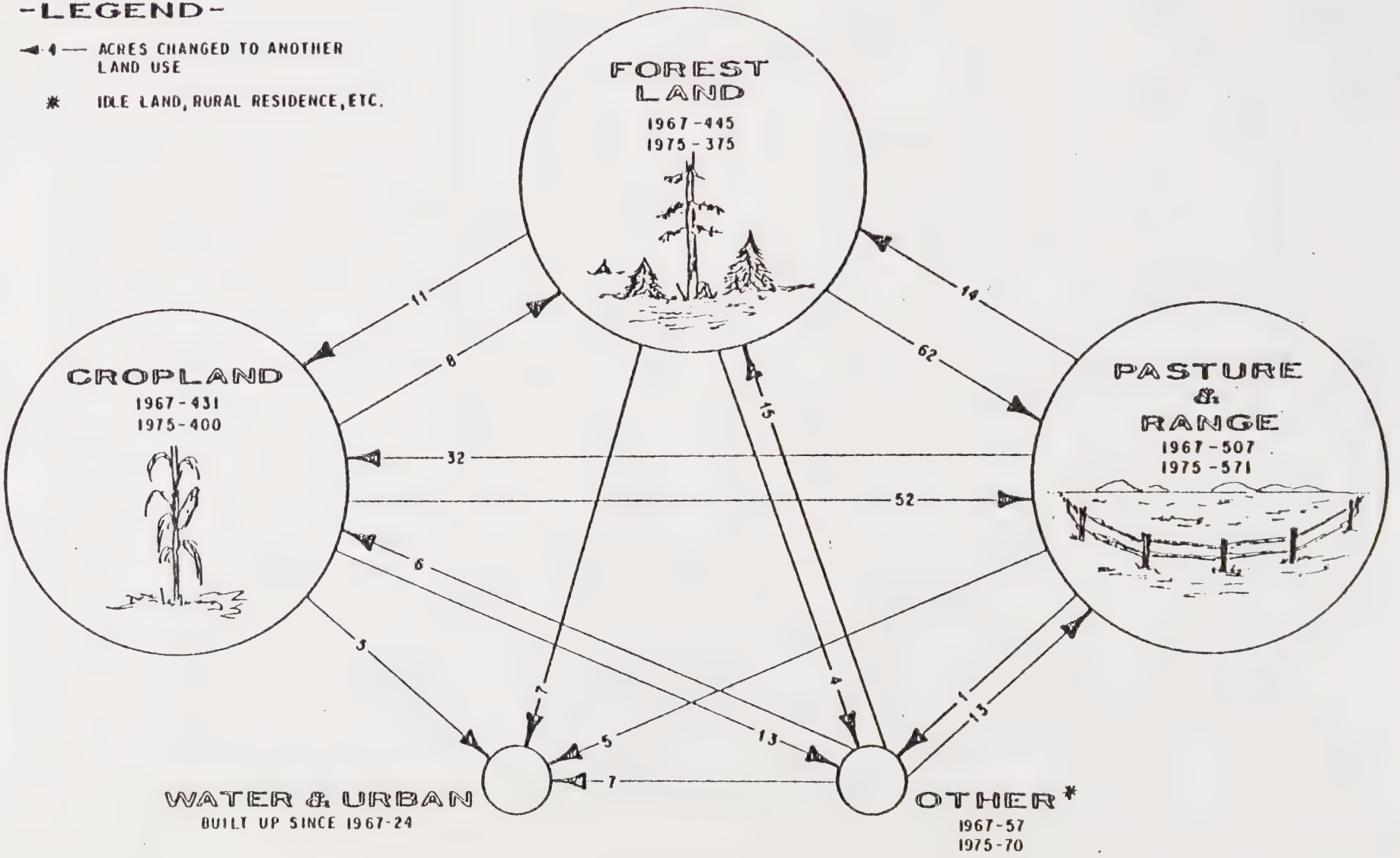
[1]Preliminary.
[2]Cropland harvested, crop failure, and cultivated summer fallow.
[3]Grassland and other nonforest pasture and range.
[4]Excludes reserved forest land in parks and other special uses. Includes forested grazing land.
[5]Includes urban and transportation areas, Federal and State areas used primarily for recreation and wildlife purposes, military areas, farmsteads, farm roads and lanes, and misc. other uses.
[6]Remeasurement and increases in reservoirs account for changes in total land area except for the major increase in 1959 when data for Alaska and Hawaii were added.

Source: USDA, 1977

FIGURE 5-1

LAND USE CONVERSIONS, 1967 TO 1975 IN THE UNITED STATES

(MILLIONS OF ACRES)



REDRAWN FROM: DIDERIKSEN, 1977

(pasture and range). Much of this change is attributed primarily to low soil fertility, erosion and the existence of terrain unsuitable for efficient use of agricultural machinery. On the other hand, 49 million acres of non-cropland were converted into cropland during the same period, most of that addition coming out of the pasture and rangeland category.

There was a net loss of cropland to urban and water uses between 1967 and 1975 amounting to more than 5 million acres. Conversion of actively farmed cropland to nonagricultural uses was estimated to have taken place at the rate of 700,000 acres per year (Congressional Research Service [CRS], 1978).

Prime Farmland Conversion, 1967 to 1975. Of the over 5 million acres of cropland converted to urban and water uses between 1967 and 1975, about 83 percent (4.5 million acres) was classified as prime farmland by SCS. Other irreversible conversion of prime farmland involved 2.9 million acres withdrawn from pasture and range, forests and other uses. Total conversion of prime land to urban and water uses was 7.4 million acres over the 8-year period, or slightly less than a million acres a year.

Economic Pressures on Agricultural Landowners. Rising prices for agricultural land can pose economic problems to farm owners because higher land values are generally reflected in higher property taxes, an out-of-pocket expense. In agricultural areas at the urban-rural fringe the pressure on the farmland owner may be particularly strong, as land buyers' interest is in the land's future development potential rather than its agricultural use value. The farmer can often sell his land for far more than he could afford to pay for it to keep it in farming use.

This gap between the economic value of farmland in agricultural use vs. potential urban use can cause diminishing productivity and premature idling of cropland near urban areas. Anticipating a sale, the farmer discontinues investment in improvements and reduces maintenance costs. The farmer who decides not to sell may face continually rising costs at the edge of urban expansion approaches. He becomes increasingly adversely affected, not only by rising property taxes, but by other incidental impacts of urban development such as road congestion, air pollution and possibly limits on certain kinds of agricultural operations. Often, the farmer eventually chooses to sell the property and relocate (Snyder, 1976).

The Importance of Prime Farmlands Preservation. The conversion of prime agricultural land to urban use is, for all practical purposes, irreversible. The conversion of

prime lands to urban uses reduces the range of environmental benefits derived from the land, and represents a potential reduction in the nation's food and fiber production capabilities.

The Environmental Case for Preserving Farmlands. Given good farm management and soil conservation practices, a number of environmental benefits are inherent in the use of land for agricultural purposes. Some of the more readily identifiable benefits (EPA, 1978a) including the following:

Watershed Protection. Open lands, such as farms, help maintain local water supplies by absorbing precipitation and transferring it to the groundwater system; protect the hydrologic integrity of watersheds through the control of storm water runoff and sediment damage; protect aquifer recharge areas; and provide buffers for water supply and other natural areas.

Insulation of Environmentally Sensitive Areas from Incompatible Uses. Agricultural uses can provide both a buffer and an economically viable land use for areas subject to environmental hazard conditions (i.e., flood-prone areas, subsidence areas, wildfire hazard areas, etc.). Ecologically sensitive areas can also be buffered by farmlands, although agricultural activities may themselves pose a threat to some of these areas.

Provision of Wildlife Habitat. Agricultural areas often contain important elements of wildlife habitat. In the eastern U. S., these habitat elements often involve remnants of original habitat types which have been largely replaced by cultivated areas. In the more arid western U. S., stock ponds and irrigation systems can provide important water sources for wildlife. Fallow areas, orchards and unharvested grain crops are also important to wildlife in many areas. But in a historical perspective, agriculture has been the major source of habitat destruction, both in this country and elsewhere in the world. Modern farming practices provide very little wildlife habitat in areas of intensive cultivation (National Academy of Sciences, 1970).

Removal of Air Pollutants. Agricultural activities (cultivation, pesticide use, agricultural burning, etc.) contribute a variety of gaseous and particulate pollutants to the atmosphere. But uptake, absorption, and physical impaction on vegetation are major removal mechanisms for many air pollutants. Particulates, sulfur dioxide, nitrogen dioxide and ozone are all subject to significant removal rates when polluted air comes in contact with vegetation. Carbon monoxide and nitric oxide, on the other hand, are not removed by contact with vegetation.

Depending on pollutant concentration, the process of pollutant removal by vegetation may lead to reduced plant growth or death of plant tissues (Hill, 1971; Bennett and Hill, 1973).

The Case for Preserving Prime Lands as Reserve Capacity for Food and Fiber Production. Each increment of this highly productive or potentially productive land which is urbanized diminishes our future agricultural resource base. The annual losses, accumulated over decades, can make a sizeable dent in the total supply, and this is happening at a time when at least some observers suggest that our future food and fiber needs, domestic and export, may well exceed the production levels which a constant or declining agricultural land base can support. Future yields, future domestic agriculture needs, future export demands and the ability of American agriculture to weather inflation, land speculation and other economic pressures are some of the uncertainties the future holds.

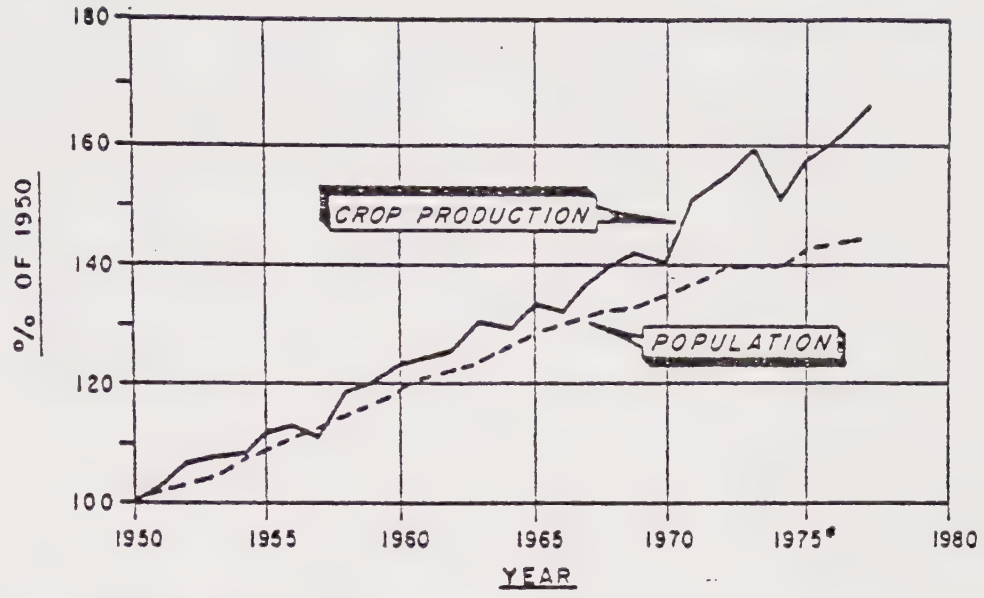
Uncertainty About Future Increases in Crop Yields. "Yield" is the amount of agricultural output which can be obtained from a given unit of land. Yields from U. S. agriculture have risen steadily over time, more rapidly than domestic population growth as Figure 5-2 shows for the period since 1950.

Technological advances have contributed to an increase in yields of about 60 percent and in total output by 160 percent from 1949 to 1975 (Figures 5-2 and 5-3). These increases took place during a period when the acreage of cropland used for crops decreased by some 20 million acres (5 percent). A major source of this increased agricultural capacity has been the development and adoption of new techniques in the production and processing of food and fiber, such as synthetic fertilizers and hybrid plants.

There is considerable doubt that historical productivity gains can continue indefinitely into the future. Constraints on the adoption of new technology such as restrictions on the use of pesticides, higher energy and energy-related input costs, as well as the necessity for cultivation of less productive lands due to the loss of better lands to urban and other uses, may restrict future yield increases (Skolds and Penn, 1977). In balancing the environmental and economic costs against the implementation of new technologies, it is expected that yields will increase, but at a slower rate than that experienced in the past two decades. In view of diminishing rates of increases in yields, the supply of land itself reemerges as the most important variable in estimating potential future agricultural output.

FIGURE 5-2

FARM OUTPUT & U. S. POPULATION



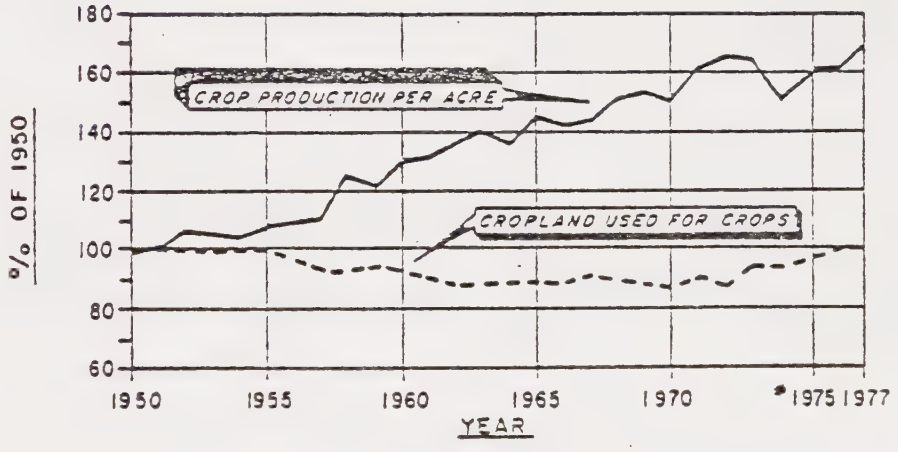
* PRELIMINARY

NOTE: INDEX OF FARM OUTPUT IS CALCULATED BY THE CONSTANT PRICE-WEIGHT METHOD AND INCLUDES ALL 50 STATES.

COMPILED FROM COTNER, 1975 & USDA, 1977

FIGURE 5-3

CROP PRODUCTION PER ACRE & CROPLAND USED FOR CROPS



* FORECAST

COMPILED FROM COTNER, 1975 & USDA, 1977

Future Domestic Needs for U. S. Food and Fiber Products. There is considerable disagreement among various forecasts of future cropland needs in the U. S. This can be illustrated by comparing the conclusions of two recent studies.

The existing cropland base is in the range of 400 million acres (Table 5-1 shows 384 million acres in 1969 and 383 million acres in 1974; both of these figures include cultivated and idle cropland). The Economic Research Service (ERS) of the USDA (Snyder, 1976) finds that cropland needs for the year 2000 will be far below that level (Table 5-2). Cropland used for crops is projected to be about 298 million acres in the year 2000 for a net decrease of 35 million acres (about 10 percent) from the 1969 level (USDA, 1974).

A strikingly different estimate of future cropland needs has been made by the Worldwatch Institute (WWI). The WWI study (Eckholm, 1976) sets forth estimates of the need for harvested cropland under five scenarios which reflect alternative assumptions regarding U. S. population growth, economic growth and technology (Table 5-3). In all of the WWI scenarios projected harvested cropland needs are much higher than the comparable values in the ERS study.

The Worldwatch scenario most demanding of cropland - the scenario assuming high population growth, high economic growth and low application of technology - would require a total of 471 million acres of cropland in the year 2000, which is only 7 million acres below the nation's long-term cropland capacity of 478 million acres (Lee, 1978). At the rate of increase in cropland requirements implied by the Worldwatch second scenario, all of the high potential cropland in the U. S. would be required for production by the year 2007. All of our prime agricultural land, in other words, would be in use, and there would obviously be cause for concern as to the nation's ability to meet any additional food and fiber needs.

The divergent conclusions of these two studies illustrate the uncertainties in the future of U. S. agriculture. Assumptions about some of these uncertainties - domestic population, economic growth and technology - have been made explicit in Worldwatch's scenarios. ERS has not made its assumptions as explicit, but has assumed that technological innovation will continue to increase production and that export demand will not significantly alter.

In view of such uncertainties, accurate estimation of future agricultural land needs is not possible. What is clear is that, under certain circumstances not wholly implausible, our supply of prime agricultural lands could be

Table 5-2

PROJECTED USES OF LAND IN THE CONTIGUOUS 48 STATES IN 1980 AND 2000 (WITH 1949 AND 1969 HISTORIC DATA)

Land Use	1949	1969	1980	2000
	(millions of acres)			
Total cropland	387	333	320	298
Cropland harvested	*352*	*286*	*292*	*272*
Forest and woodland	601	603	591	578
Pasture, range, and other agricultural land	768	767	771	782
Urban and related	42	60	66	81
Other special uses and miscellaneous uses	106	134	149	158
Total land area	1,904*	1,897*	1,897	1,897

* Change due to remeasurement

NOTE: Figures are for the contiguous 48 states; only the 1949 figures correspond to those in Table 5-1 (for 1950) because the data in Table 5-1 include Alaska and Hawaii from 1959 on.

Source: Snyder, 1976

Table 5-3

U. S. CROPLAND NEEDS IN THE YEAR 2000 UNDER FIVE ALTERNATIVE DEVELOPMENT SCENARIOS

		Actual	Year 2000 Scenario				
		1970	1	2	3	4	5
Assumptions	Population (millions)	204	321	321	321	266	266
	Economic growth	---	High	High	Low	High	Low
	Technology	High	High	Low	Low	High	Low
Outcome	Harvested cropland (million acres)[1]	344	391	438	436	359	390
	Cropland not harvested[2]	96	31	33	32	51	32
	Total cropland	440	422	471	468	410	422

[1]Includes pasture in cropland.
[2]Includes about 30 million acres required for failure and summer fallow, the remainder being unused.

SOURCE: Eckholm, 1976

fully in use early in the 21st century; a backup supply of agricultural lands will exist, to be sure, but of lesser quality, involving higher production costs, lower yields and rapidly rising domestic food prices. Loss of prime lands to urbanization poses a problem because such losses are irreversible and because the supply is finite. The cumulative effects of the alienation of these resources from agriculture may well pose a serious future problem for the nation.

Demand for Agricultural Exports. Thus far, the discussion of agricultural land requirements has focused on domestic food requirements; export levels have been assumed relatively stable. Significant increases in export demand would accelerate the events described in Worldwatch's second scenario and would increase the cropland need estimated in both the studies cited. Because the ERS estimate was published prior to the recent dramatic increases in U. S. agricultural exports, it probably does not fully reflect the potential future worldwide demand for U. S. agricultural products.

Recent experience - the 1974 world food shortage, for example - shows the relationship between export demand and U. S. domestic food prices and production levels. With shortages raising international prices for agricultural commodities, the federal government released almost all of the farmland retained under supply management programs (Cotner, 1975). But food prices nevertheless rose sharply; between 1972 and 1974, food prices rose over 30 percent while prices of all items (including food) rose less than 20 percent. With rising food prices, consumers have been forced to spend an ever increasing percentage of their income on food. Policies designed to preserve the productive land base would help insulate domestic consumers from price increases due to increased export demand.

A growing farm export market has had a favorable effect on the nation's balance of trade. Acreage harvested for agricultural export increased from 69 million acres in 1967 to 100 million acres, or 30 percent of the total acreage harvested, in 1975 (USDA, 1977). In 1977 the country suffered a $27 billion trade deficit, but agriculture had a net surplus of $10.6 billion (CRS, 1978). As inflation and a growing trade deficit erode the dollar's buying power, measures taken to preserve croplands will help ensure agriculture's ability to offset the increasing costs of imports.

Prime Farmland Preservation: A Growing National Concern. The issue of farmland depletion and particularly the irreversible conversion of prime farmland to nonagricultural use has prompted federal legislation designed to protect our agricultural land resources. Legislation proposed in the 95th Congress included the Agricultural Land

Retention Act (H.R. 11122) and similar Senate Bills, S. 1616 and S. 2757 (CRS, 1978). Essentially these bills would have provided funding to study agricultural land conversion and to make recommendations for possible modifications in federal land use policies to prevent the depletion of the nation's prime farmland. None of these bills was acted upon by the 95th Congress.

Prime Farmland in California

Agriculture in California's Economy. California's wide variety of quality soils, unique climatic conditions and abundant irrigation water permit the commercial cultivation of over 200 crops. The state produces 25 percent of all table food and 40 percent of all fresh vegetables and fruit consumed in the nation (Reed, 1977). Agriculture is one of California's major industries: an estimated $8.6 billion in cash receipts at the farm level generated approximately $45 billion or 24 percent of the state's aggregate output of $190 billion in 1975 (California Legislature, 1977a). Agricultural land use amounts to 36.1 million acres of the state's 100.1 million acres in 1975; however, most of the cash return from crops was derived from production on the 3.7 million acres of irrigated land in the state (California Department of Water Resources [DWR], 1974).

The Prime Farmland Inventory. California developed and applied a definition of prime farmland prior to the more recent definition developed by SCS for the national land inventory (see discussion earlier in this chapter of the SCS definition, p. 2). The California definition is spelled out in the California Land Conservation Act of 1965, and is referred to in this chapter as the "CLCA" definition. It is more inclusive than the SCS definition because it includes lands which return a gross revenue of $200 per acre, irrespective of their soil quality.

Table 5-4 sets forth estimates of the amount of prime agricultural land in California under both CLCA and SCS definitions. The more restrictive SCS definition results in an inventory of 9 million acres, 3.6 million acres less than the CLCA definition (Singer and Reganold, 1978).

Potential Prime Farmland. Potential prime farmland is defined as that land which has the capacity to be made prime (according to the CLCA definition) through normal agricultural investment and practices (California Office of Planning and Research [OPR], 1974). OPR estimates that there are 8 million acres of potential prime land in the state. In contrast, SCS estimates only 4 million acres, based on the acreage of presently nonirrigated Class I and Class II soils. Most of these lands are located in the Mojave Desert and the Owens Valley; the remainder are scattered in small parcels in coastal valleys. Only a

small fraction of this acreage is found in the major agricultural areas of the state.

Table 3-4

CALIFORNIA PRIME FARMLAND INVENTORY

	Prime Farmland	Potential Prime Farmland	Total
Office of Planning and Research (CLCA[1] classification)	12.6	7.98	20.58
Soil Conservation Service (LIM[2] classification)	9.0	4.00[3]	13.00[3]

[1]CLCA definition includes all lands meeting at least one of the following criteria: (1) Class I and Class II soils as defined by SCS; (2) land that returned an annual gross value of not less than $200 per acre; (3) land qualifying for a rating of 80 to 100 in the Storie Index of Soil Classification; (4) land that supports livestock with an annual carrying capacity equivalent to at least one animal unit per acre, as defined by the USDA; (5) land planted in fruit or nut-bearing trees, vines, bushes or crops that have a nonbearing period of less than 5 years, and that will normally return $200 per acre per year (Hanson and Schwartz, 1976).
[2]U. S. Soil Conservation Service, 1977.
[3]Contingent upon water availability.

Source: Singer and Reganold, 1978

Trends in Agricultural Land Conversion. Past changes in California's agricultural land use are well known in both technical and popular literature. The Santa Clara Valley was a prime orchard area prior to 1950, yet from 1940 to 1970 over 40,000 acres of prime orchard land was taken out of production as population increased from 310,000 in 1950 to over 1 million in 1970 (Holloway, 1977). Since 1970, this trend has accelerated as approximately 24,000 acres of prime orchard land have been lost (Santa Clara County Department of Agriculture, 1977).

San Diego County's unique Mediterranean climate and fertile soils have made this area a leading producer of California specialty crops. But between 1950 and 1966, population pressure had forced the conversion of over 63,000 acres of prime farmland to urban uses (San Diego County, 1968) and the area has lost its former leadership position in citrus and nut production.

Generally, agricultural activities formerly located in the urban coastal counties have shifted to the San Joaquin Valley, where vast acreages have been brought into intensive

cultivation through implementation of major irrigation projects. It is estimated that about 55,000 acres per year of land are being reclaimed for intensive crop production (OPR, 1974).

However, prime agricultural land is also being absorbed by continuing urban expansion at the rate of 20,000 to 25,000 acres per year (DWR, 1974). Projections by OPR indicate that urbanization of prime farmland during the 1974-85 period will average 50,000 acres per year, and 80,000 acres per year if potential prime land is also included. In view of the fact that DWR estimates of past prime farmland losses were about 25,000 acres per year, the OPR estimates of future losses show a considerable acceleration of this trend.

Future Prospects for California Agriculture.

Impediments to Reclamation of Additional Lands. The major impediment to the upgrading of potential prime land to prime land status is the lack of irrigation water supplies and a decrease in the amount of new water supplies available for agricultural use. Currently there is a gap between the supply of water and the demand, which agriculture is compensating for via groundwater overdrafting. New water projects would be needed to upgrade potential prime land to prime, and current prospects for construction of such projects are not favorable.

Less valuable agricultural lands - "marginal" lands - might also be brought into production if the long-term need warranted and if water were available. However, higher costs of production are incurred because these reclaimed marginal lands are less productive and require greater use of fertilizers, longer transport distances, and have lower yields over which to spread costs. Greater capital costs on these lands result from the need for more extensive water delivery systems, land and soil improvements and other fixed costs.

High capital costs required for development of new croplands in California are illustrated by experience in the Westlands development project in Fresno County, where subsidies approaching $2.5 billion in the next 40 years may be needed to bring only 600,000 acres into production (California Legislature, 1977b). The primary reason for the decrease in return for new farmland is that the optimum conversion sites for agriculture purposes have been used up, and the crop yields on marginal lands are not adequate to pay back the high construction costs of the needed water supply projects. These factors indicate that the small reserve of prime agriculture land and the low economic viability of new water projects reduces the feasibility of replacing lost prime land with lower quality marginal lands.

Projections of Future Agricultural Land Use. Projections by the DWR in 1974 of future water demands and the ability to meet these demands in the years 1990 and 2020 are summarized in Figure 5-4 and Table 5-5. High demand scenarios for irrigated land based on agricultural growth are represented by Alternatives I and II, and future agricultural water needs for these respective alternatives will exceed projected water supplies. If, however, either of the lower demand levels represented by Alternatives III and IV is realized, projected water supplies will be sufficient for agricultural use.

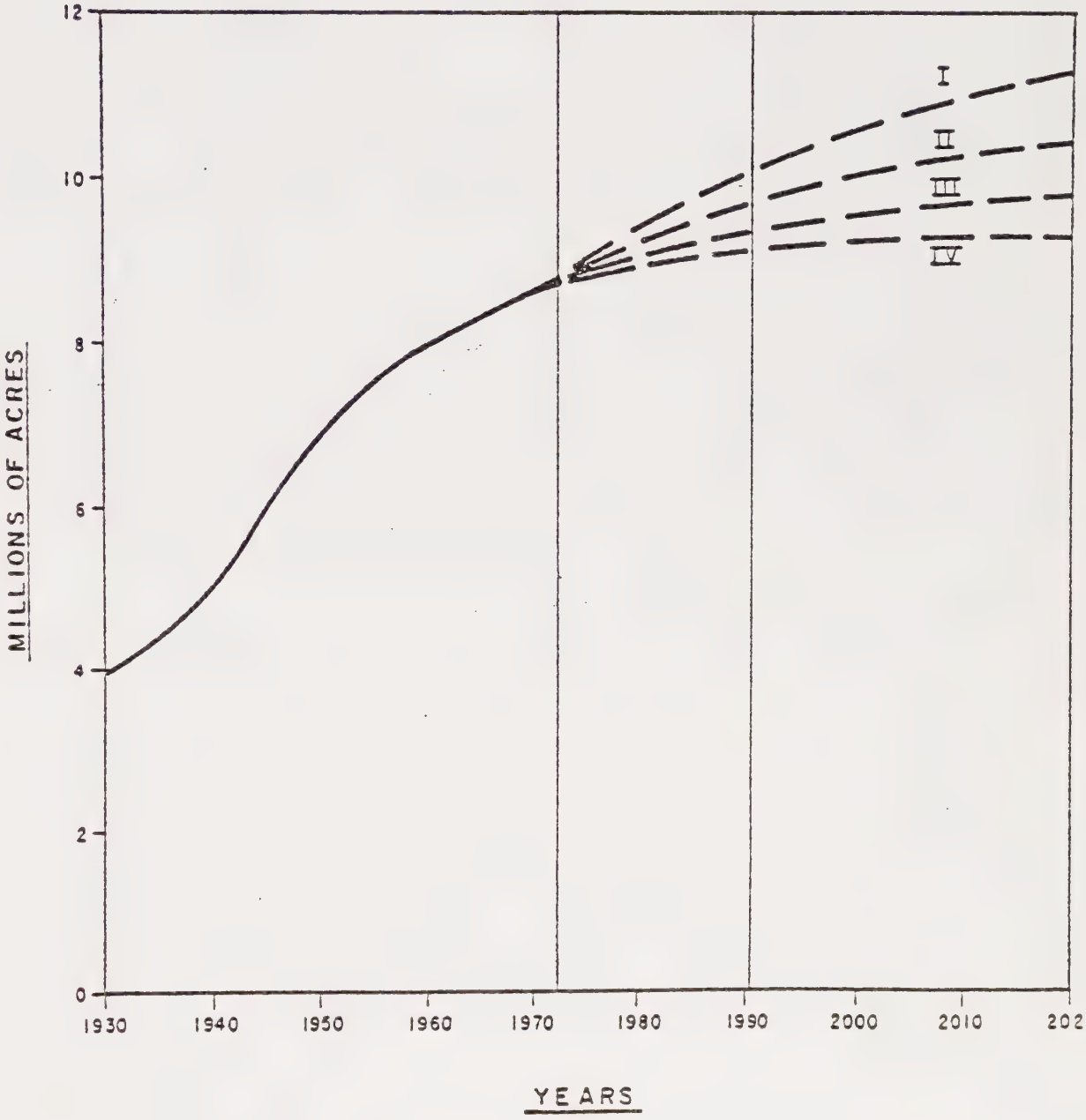
In all four scenarios total water demand would exceed dependable water supplies. The deficit would have to be made up by groundwater overdrafts, providing that such a degree of overdraft is technically and economically feasible.

The outcomes of the four scenarios could be significantly different from DWR's projections if urbanization expands at a faster rate or if new water supply facilities lag behind urban development more than expected. In fact, construction of a number of the water projects on which the DWR supply forecasts are based has been postponed, suspended or cancelled. The forecast of dependable water supplies may consequently be too high.

Recognition of Prime Farmlands Preservation as a State Policy. Because of the uncertainties mentioned above, the Legislature has taken actions directed toward preserving California's prime farmland. Several bills have been introduced to create an Agricultural Resources Council at the state level to oversee the establishment of agriculture preserves. These bills would also require detailed mapping of existing prime lands and development of local land use plans aimed at protection and preservation of these lands (California Legislature, 1977a). However, no agricultural preservation bill has yet been enacted into law.

FIGURE 5-4

HISTORICAL CONDITIONS & PROJECTED IRRIGATED LAND AREA REQUIREMENTS IN CALIFORNIA



SOURCE: DWR, 1974

Table 3-5

EXISTING (1972) AND PROJECTED AGGREGATED WATER SUPPLY AND DEMAND AND ACREAGE UNDER IRRIGATION

	1972	1990	2020
Total Water Supplies	30,700	35,700	36,400
Alternative Futures:			
I. Water demand (1,000 acre-feet)			
total	37,400	46,200	55,300
agricultural	31,700	37,900	41,900
all other uses	5,700	8,300	13,400
Acreage under irrigation (1,000 ac)	8,780	10,200	11,360
II. Water demand (1,000 acre-feet)			
total	37,400	44,400	50,800
agricultural	31,700	36,400	39,000
all other uses	5,700	8,000	11,800
Acreage under irrigation (1,000 ac)	8,780	9,740	10,520
III. Water demand (1,000 acre-feet)			
total	37,400	42,400	47,000
agricultural	31,700	34,600	36,100
all other uses	5,700	7,800	10,900
Acreage under irrigation (1,000 ac)	8,780	9,380	9,850
IV. Water demand (1,000 acre-feet)			
total	37,400	41,100	42,900
agricultural	31,700	34,000	34,600
all other uses	5,700	7,100	8,300
Acreage under irrigation (1,000 ac)	8,780	9,180	9,360

Source: DWR, 1974

APPENDIX D

WATER SUPPLY IN THE NORTH NATOMAS

This appendix is intended to provide the reader with an overview of water supply and drainage issues in the North Natomas. The information presented was provided by staff of Reclamation District 1000.

DRAINAGE AND THE INITIATION OF CULTIVATION

The region known as North Natomas was formerly referred to as the "American Lakes Region". This designation was due to the fact that, for most of the year, North Natomas lay underwater. Elevations throughout the area are only ten to fifteen feet, while adjacent rivers peak at 28 feet.

It was not until 1911, when the Natomas Company petitioned the state to establish a reclamation district, that the area became useful for cultivation. The legislature created Reclamation District 1000 in 1911. Soon thereafter, the District placed levees along the Sacramento River, at the confluence of the Sacramento and American rivers and at the location of the present East Levee, making it possible to pump water out of the area. By 1916 what was initially submerged became dry land, and cultivation on a major scale began.

Reclamation District 1000 continues to be responsible for drainage and for maintainance of canals and levees in the area.

THE WATER COMPANIES

In 1916, the first water company in the North Natomas, Riverside Mutual, was established. Subsequent companies were the Elkhorn Water Company, formed in 1919, and the Natomas Central Water Company, formed in 1922. The three merged in 1935 under the Natomas Central name. Natomas Central currently is responsible for the irrigation of about 35,000 acres. It is the local entity which contracts for water from state and federal water resource agencies.

CURRENT WATER SUPPLY CONDITIONS

The North Natomas obtains its irrigation water from two sources: it contracts for irrigation water and it recovers and recycles some of that water.

Contract water is supplied both by the Feather River Project (California State Water Plan) and by the Shasta Dam on the Sacramento River (Central Valley Project of the U. S. Department of the Interior). Contracts total 120,000 acre-feet per year. Neither water resource agency has an excess of water such that the Natomas Central could increase its contracted amount.

The switch to rice cultivation has created a gap between the contracted water supply and actual water use levels in the area, which generally is between 160,000 and 180,000 acre-feet a year. The District makes up the difference by recovering and recycling of water at a rate of 45 to 50 percent. Water is drawn off the low-lying edge of the fields into the levee and pumped back into the irrigation channels.

During droughts, water allocations to Natomas Central can be reduced. In 1977, the allocation was reduced by 25 percent. Through a strict rationing program, usage was contained to within two percent of the reduced allocation.

DRAINAGE PROBLEMS POSED BY DEVELOPMENT

The Reclamation District is concerned about what it sees as the lack of coordinated planning in the North Natomas and piecemeal development patterns, which make provision of adequate drainage facilities difficult or impossible. The District's current policy is to ask that building permits be withheld on development within the area until the District is satisfied that the necessary drainage facilities are provided. The cost of providing adequate drainage facilities for the entire area in the event of urban development would likely run into millions of dollars, according to District staff.

APPENDIX E

THE VALUE OF AGRICULTURAL LAND

THE LAND USE HIERARCHY

Agricultural land is part of the total land market within which prices derive from the usefulness of individual parcels in comparison to all other parcels in the same use and by the competition among uses, as the economist Ricardo has described. Certain uses command higher market prices than others, as is illustrated by the following land use hierarchy (Healy, 1979):

Use	Typical Land Value
Urban uses	$5,000-50,000+
Orchard, specialty crop	2,000- 7,000
Rural residence	1,000- 5,000
Corn, soybeans	1,000- 4,000
Developed pasture	300- 1,000
Wheat	200- 500
Forestry (bareland value)	100- 600
Rangeland grazing	50- 200

This hierarchy is not immutable, but change takes place very slowly, and prices alter more quickly than uses. Where agriculture is becoming less profitable, marginal operators may nevertheless continue farming for years, in part because they may know no other occupation. On the other hand, land that is much more valuable for urban uses may be kept in agriculture because of owners' individual preferences, estate planning considerations or other personal factors. The straightforward observation that land is in agricultural production is not conclusive regarding either that land's highest and best use, or its value.

APPROACHES TO VALUING AGRICULTURAL LAND

Appraising as a profession emerged, in part, as a result of the collapse of farmland prices in the 1920s. Banks and other lenders sought ways to estimate more accurately the value of land (and related agricultural assets) on which

they were making loans. Two major approaches to valuing farmland emerged in the 1930s and 1940s, each of which parallels methods of valuing urban land uses. A third method, commonly used in urban contexts, is less applicable than the others to farmland valuation.

Valuation Based on Income Capitalization

This approach is based on the premise that the value of farmland depends on its ability to generate income. The value of that income stream is greatest for earlier years, and declines the farther into the future it is projected: future incomes are "discounted" as compared to present incomes. The mechanism for estimating value is given by the formula:

$$\text{value} = \frac{\text{annual net income}}{\text{capitalization rate}} \quad -$$

in which the capitalization rate, in effect, discounts future income. To provide an example, if net income in a given year is $100,000 and the capitalization rate is 10%, then the estimated value of the farmland would be $1,000,000.

There are a number of difficulties involved in valuing farmland in this way. For one, calculating net income accurately can be nearly impossible, because both input costs and product sales prices vary from year to year, and certain other factors (such as the cost attributable to family labor and the wages to be paid to management) are difficult to price. These obstacles can be overcome to some extent if there is substantial renting of farmlands in a given market. In that case, the rent received by the owner, less the owner's costs, represents net income, and the problem of estimating expenses and receipts is bypassed.

A second difficulty arises in the case of agricultural operations in which land is a small factor in the total cost picture. This may be true in certain types of agricultural operations such as dairies with confined feeding, mushroom farms and poultry farms. The income approach is also less reliable

where some cost other than land looms very large on the cost side. For example, if fertilizer is a big input and there is a large yearly variation in fertilizer costs, it may not be possible to project future costs accurately.

Finally, the results of the income approach are rarely as high as the sales prices farmland actually commands. The difference is accounted for by "intangible and nonincome features" (Murray, 1961) such as the amenities of the property and anticipated increases in value.

The approach of California county assessors in estimating farm use value in implementing the Williamson Act is primarily the capitalization of income approach. Actual practice in estimating the parameters of income and receipts varies considerably among localities (State of California, 1980). California conditions at present, however, conform to the national situation in that farm use value lies considerably below market prices.

Valuation Based on Comparables

The second basic approach to valuing farmland is by comparing a given property to other similar properties which have changed hands in the recent past and using their sales prices as the basis of the value estimate. This approach also poses some difficulties if sales data are out of date, scarce or unreliable, and the uniqueness of each parcel of land means that comparables are never exactly comparable. Nevertheless, if there are good sales data, estimates can be made which, in a rising market for land, are far more likely to predict a given sales price accurately than an estimate based solely on the income approach.

As a practical matter, farm appraisers tend to use both approaches in a complementary manner, with the gap between them accounted for by a variety of factors the appraiser is familiar with: the quality of the farm home, the distance from the market, convenience/inconvenience factors presented by neighboring land uses, and so forth.

In estimating farmland values over a large area like the North Natomas, comparison to recent sales prices within the area would provide a good initial starting point. However, it must be kept in mind that at any point in time, bringing a large quantity of land onto the market at once tends to have a dampening effect on prices. Reclassification of a very large area from agricultural to urban use zoning would be likely to reduce land prices, at least over the time period required actually to bring all that land into the urban development stream. So in using sales prices as an indicator of value, accuracy is highest if we keep in mind that we are always talking about the next transaction, not all future transactions.

Replacement Costs

In the urban context, a third approach to valuation is frequently applied: estimates of the replacement cost of a given use. This approach is not used in valuing agricultural land, because such land is not replaceable.

However, replacement cost estimates may be relevant if the issue addressed is one of irreversible commitment of an important agricultural land resource to urban use. The price paid for the land, in such a case, reflects the land's urban value. The beneficiaries of the existing pattern of agricultural production, whose foodstuff purchases represent part of the land's agricultural value, are not refelcted in such market transactions.

If the land in its agricultural use possess characteristics such that it is able to produce relatively high yields at low input costs compared to other lands, then the consumer may experience a cost in the loss of that land to urban use because the cost of supplying that food commodity at alternative sites may be higher. Thus, from a resource perspective, it may be important to know whether there are in fact alternative lands available to replace those converted to urban use, and whether the input costs pertaining to those alternative sites would be higher, and/or the yields lower, resulting in higher future costs to consumers. This question is addressed, for cultivation alternatives to the North Natomas, in Chapter III of the report.